



ERM Romani BESS

Surface Water Impact Assessment

BNTL00206_0007-REP-001-2

25 AUGUST 2025

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1	20/06/2025	Client Issue	Laura Vincent	Susan Shield	Laura Vincent	Susan Shield
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EXECUTIVE SUMMARY

OVERVIEW

Samsung C&T Renewable Energy Australia Pty Ltd (SREA) (the Applicant) proposes to develop the Romani Battery Energy Storage System (BESS) (the Project). The Project is proposed to involve the construction, operation, and decommissioning of a BESS with approximately 200 megawatts (MW) / 800 megawatt hours (MWh) of generation capacity. The project is located approximately 44 km south-west of Hay and lies entirely within the Edward River Local Government Area (LGA) in the Riverina Murray Region of New South Wales (NSW).

The Project is State Significant Development (SSD) and therefore requires an environmental impact statement (EIS) to be prepared under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979*. This Surface Water Impact Assessment (SWIA) supports the SSD application as an appendix of the EIS for the Project and provides an assessment of the potential impacts to surface water as a result of the Project. The SWIA documents the assessment methods and results, initiatives to avoid and minimise surface water impacts, and additional mitigation and management measures proposed to address residual impacts not able to be avoided.

BASELINE CHARACTERISTICS

Surface Water Context

The Project is located within the Murrumbidgee catchment area, a tributary of the Murray River. To the north of the Project, potential connectivity exists between the Murrumbidgee River and the Project Area via numerous diverting anabranches and flood runners, such as the ephemeral The Forest Creek, which is located within 700 m of the southern boundary of the Project Area. While there is potential for the Project Area to be impacted by breakouts from the Murrumbidgee River, recent studies in the region (Lyll & Associates, 2024) indicate that local flooding caused by direct rainfall on the upstream catchment represents the worst case flooding conditions for the floodplain. Similarly, coincident flooding with the Murrumbidgee River is considered highly unlikely due to the orders of magnitude differences in catchment sizes of the Murrumbidgee River and the Project Area local catchment. No coincidence event was investigated, as the chance of major events occurring simultaneously was deemed to be extremely rare.

The Project Area is located approximately 44 km south-west of Hay, and 15 km north-west of the Booroorban village, within an expansive and flat landscape dominated by large floodplains and a network of ephemeral flow paths. The Project Area is located within the Coleambally Irrigation Co-Operative Limited (CICL) water management area with the Coleambally Outfall Drain running in an east to west direction, located south of the Project Area.

Local drainage systems within and surrounding the Project Site are not well-defined, and existing agricultural dams influence flow regimes during events. There are no mapped watercourses located within the Project Site, however one mapped hydroarea (waterbody) crosses through the south-west corner of the Project Site. The local catchment is dominated by flat topography, with elevations through the Project Site ranging between 80 mAHD to 82 mAHD.

Flooding

Detailed flood modelling of the Project Site was undertaken as part of the SWIA. Due to the flat landscape within the region, catchment delineation to inform a hydrological model was difficult and therefore a two staged hydraulic model approach was undertaken, using rain-on-grid (RoG) modelling techniques. This included the development of two separate models:

- Regional Catchment Study Area – this model undertook a catchment wide rain-on-grid (RoG) approach to modelling the upstream reporting catchment for the Project Site, to provide hydrograph inflows to a smaller scale site model.
- Local Project Site – this model simulated the Project Site separately to the regional catchment, applying a local RoG inflow, whilst also utilising the hydrographs extracted from the downstream boundary of the Regional Catchment Hydraulic Model to represent the wider catchment contribution.

As the site is located within the floodplain, it is anticipated that during an event which engages the Murrumbidgee River, flows would breakout and could engage the surrounding floodplain, potentially impacting the site. However, flood assessments for other Projects within the region have indicated that the local contributing catchment plays a more significant role in impacts to the floodplain. Impacts of riverine flooding would therefore be considered during post approval and, if required, can be incorporated for the detailed design of the site infrastructure and the Emergency Response Plan.

The site is inundated in all scenarios by overland sheet flow from the local catchment, with peak flood depths of around 0.5 m predicted for the 1% Annual Exceedance Probability (AEP) event.

Water Supply

The Applicant does not own any land within the Project Area and would therefore rely on external agreements for water sourcing. Water supply for the Project will be transported to site by tanker. Potable and non-potable water demands would be met in accordance with agreements with Edward River Council, neighbouring Councils or other local private water supply companies. A separate dedicated fire water tanks supplied by rainwater. Non-potable water needs for construction and operation would be sourced through external supply agreements.

Groundwater extraction is not currently proposed, however, may be considered during detailed design if deemed necessary to support construction. The Applicant would obtain applicable WALs, works approvals and water use approvals prior to any water extraction taking place.

POTENTIAL IMPACTS

Watercourse Characteristics

The Project would not require modification or realignment of mapped watercourses or waterbodies in the Project Site, minimising impacts on natural flowpaths and stream ordering. While construction and operation infrastructure may result in some disturbance to minor flow or drainage paths, efforts would be made to utilise existing access tracks and limit water crossings where possible.

Where placement of infrastructure may require filling of potential flow paths or flood storage areas, the Project would aim to achieve a balance of cut and fill across the site to mitigate downstream impacts. These measures would be further refined and optimised during the detailed design stage.

Flooding

The flood model was used to simulate the developed conditions for the 5% AEP, 1% AEP and the Extreme (Probable Maximum Flood (PMF) equivalent) events. Results indicate that flooding increases within the Project Site associated with the Project infrastructure are typically minor and do not present significant erosion or inundation risks. The positioning of the proposed BESS, within the downstream overland flow paths, is expected to result in some increases to neighbouring properties in the 1% AEP and Extreme events.

A climate change sensitivity was undertaken by modelling the 0.5% and 0.2% AEP events under existing conditions, which are typically used as proxies for climate change. The climate change sensitivity modelling indicates that there is generally little difference in flood extent across the Project Site for the two climate change scenarios.

Surface Water Quality

Construction, operation, and decommissioning phases pose potential risks to surface water quality, including:

- Soil erosion and sedimentation of downstream watercourses and crops.
- Spill of hydrocarbons or other pollutants used to support transportation and installation activities.
- Release of concrete by-products (dust, slurry, water) into downstream watercourses and crops.
- Discharge/spill of wastewater (treated or untreated) into downstream watercourses and crops.
- Release of tannins to downstream watercourses and crops.

These risks can cause harm to aquatic life, contaminate watercourses, and impact crops. Mitigation measures, such as an Erosion and Sediment Control Plan (ESCP), hydrocarbon storage controls, and wastewater management systems, are proposed. Through best practices and proposed measures, the overall impact on water quality is considered negligible, given the limited connectivity to adjacent watercourses. Operation and decommissioning phases share similar risks, but with appropriate management measures, the expected impact on water quality during decommissioning is also considered negligible.

Cumulative Impacts

The cumulative impact assessment for the Project, in accordance with State Significant Project guidelines, acknowledges the potential cumulative effects arising from the incremental influence of multiple energy projects within the South West Renewable Energy Zone (REZ). Although individual impacts from specific projects may be minor or negligible, the collective influence can be more significant over time. The

Project, is located within proximity to 15 known energy projects, including wind and solar installations and a new electricity transmission line, and has undergone a comprehensive assessment considering potential cumulative impacts.

Surface water quality and flow were assessed with a focus on The Forest Creek, a common water receptor connected to the Project Site. However, no direct interactions are expected, and with proposed mitigation measures, cumulative impacts on surface water are expected to be negligible.

MITIGATION AND MANAGEMENT MEASURES

Detailed environmental studies have been undertaken for the Project design. The consideration of the outcomes of these studies in the design and integration with the approved operations minimise the potential for impacts on surface water resources. These considerations include:

- The management of impacts within the existing water allocations.
- Project design to meet legislative requirements and relevant guidelines.

These factors reduce the potential for significant impacts on existing surface water resources. The range of potential impacts resulting from the Project and a summary of the proposed mitigation measures is included in Table 1. It should be emphasised that the majority of the proposed mitigation measures are consistent with best practices for the development of large-scale electricity infrastructure. This is appropriate and to be expected given the generally small incremental impact due to the minor disturbance associated with the Project infrastructure.

TABLE 1: SUMMARY OF POTENTIAL IMPACTS AND MITIGATION MEASURES

Potential Impacts	Mitigation Measure	Project Implementation Stage
WATERCOURSE CHARACTERISTICS		
Filling of streams for infrastructure / water crossings	Consider the following mitigation measures in the Project detailed design: • Limit water crossing to existing access tracks where possible. • Arrange Project infrastructure such that stream disturbance and modifications (filling / diversions) are limited to minor watercourses. In the event construction of waterway crossings is required, these would be designed, constructed and maintained to consider <i>DPE Guidelines for instream works on waterfront land</i> (DPE, 2022) and <i>Guidelines for riparian corridors on waterfront land</i> (DPE, 2022).	Detailed design
FLOODING		
Impacts to in-stream and overland flooding	Consider the following mitigation measures in the Project detailed design stage to minimise impacts to flooding possible: • Minimise filling of BESS, substations sites and on-site facilities. • Minimise extent of Project infrastructure within the 1% AEP flood extent. • Design to manage flood impacts and flow conveyance at watercourse crossings (if any).	Detailed design
Impacts on the Project design due to predicted flooding	Optimisation of the Project design during detailed design to ensure: • permanent ancillary infrastructure (BESS/substation) is located above the flood planning level (1% AEP + 500 mm freeboard).	Detailed design

Potential Impacts	Mitigation Measure	Project Implementation Stage
Impacts to site personnel during a flood event	Floodplain management planning to determine site management protocols during flood events that could impact construction or access areas, including: • Suitable early warning and communication protocols. • Triggers for closure, evacuation and recovery. • Emergency response and support.	Post Approval / Pre-construction
Increased stormwater runoff from vegetation clearing and filling for infrastructure	Increased stormwater runoff during operations (due to clearing of vegetation and filling for infrastructure) would be managed through development of erosion and sediment control plan (ESCP). The ESCP should consider: • Location of site infrastructure away from existing watercourses or areas subject to high levels of overland flow. • Diversion of upstream flows around site infrastructure as required, to minimise scouring and erosion. • Inspection and monitoring regimes to maintain stormwater and erosion and sediment control structures.	Construction
WATER QUALITY		
Erosion and sedimentation of downstream watercourses	Development of erosion and sediment control plans (ESCP) through all project phases, in accordance with <i>Managing Urban Stormwater: Soils and Construction – Volume 1</i> (Landcom, 2004), <i>Volume 2A Installation of services</i> (DECC, 2008), <i>Volume 2C Unsealed roads</i> (DECC, 2008), <i>Volume 2D Main road construction</i> (DECC, 2008) and <i>Best Practice Erosion and Sediment Control</i> (IECA, 2008). The ESCPs would detail area specific erosion and sediment control measures to be implemented and maintained during construction until the design intent is met by the as-built infrastructure and rehabilitated vegetation. As well as ongoing monitoring and maintenance through operation and decommissioning of additional controls if identified as required. The total area of disturbance at any time should be minimised where possible and ongoing rehabilitation and stabilisation strategies implemented throughout construction.	Construction
Release of sediment or construction by-products	During construction, the following management measures would be considered to minimise the potential for mobilisation of sediment or dust from topsoil stockpile: • Locate stockpiles away from drainage lines, or areas subject to high levels of overland sheet flow and minimise stockpile size. • Develop and implement area specific erosion and sediment control measures including bunding and diversion drains as required. • Use stockpile stabilisation techniques such as covering or dust suppression.	Construction

Potential Impacts	Mitigation Measure	Project Implementation Stage
Contaminant spills	Prior to commencing construction activities, a Construction Environment Management Plan (CEMP) would be developed to identify site specific controls and procedures to minimise the potential for hydrocarbons and other contaminants being discharged into the environment. This CEMP should consider: • Storage of hydrocarbons and other liquid chemicals within an above ground, bunded area away from watercourses or area subject to high levels of overland sheet flow. • Re-fuelling of construction vehicles and equipment to be limited to designated areas, with adequate spill management controls. • Maintain an emergency spill kit and relevant emergency spill response procedures. • Transport and dispose of any hydrocarbons captured during Project construction and operation of the substations and switchyards at a suitable off-site licenced facility.	Construction, Operation
Surface water and groundwater quality impacts	The CEMP should consider the following management measures to minimise the potential impacts to surface water and groundwater quality within and surrounding the Project Site: • Develop and implement a suitable monitoring regime of all stormwater and erosion and sediment control structures, particularly following large flow events.	Construction, Decommissioning
WATER SUPPLY		
Water licences to meet demands	All required water licensing and approvals would be coordinated with associated landholders and/or regulators (e.g. Council, others) if that source is needed to support water supply arrangements for during construction and operation.	Post Approval (Construction, Operation)
WASTEWATER MANAGEMENT		
Discharge of wastewater or effluent from site	Design and implement a wastewater treatment system that: • Is appropriately sized for the Project infrastructure and operations. • Collects and treats wastewater from site offices and temporary accommodation facilities for re-use on site to fulfill non-potable construction and operation demands. • Be designed and operated in accordance with best practices.	Detailed design

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1. INTRODUCTION

1.1 Overview

Engeny Australia Pty Ltd (Engeny) has been engaged by Environmental Resources Management Pty Ltd (ERM) on behalf of Samsung C&T Renewable Energy Australia (SREA or the 'Applicant') to conduct a Surface Water Impact Assessment (SWIA) for the Romani Battery Energy Storage System (BESS) (the Project).

Surface water impacts assessed for the construction, operation and decommissioning phases of the Project have been addressed in this report, in accordance with relevant regulatory and statutory requirements.

This report has been prepared to support a State Significant Development (SSD) application for development consent under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (SSD-67105475). This report is an appendix to the Environmental Impact Statement (EIS) prepared for the Project.

1.2 Relevant Policies, Guidelines and Legislation

The following policies, guidelines and legislation have been considered in this assessment:

- *Water Management Act 2000*.
- Water Sharing Plans.
- *Water Management (General) Regulation 2018*.
- Groundwater Guidelines for major projects (<https://www.dpie.nsw.gov.au/water/our-work/licensing-and-trade/major-projects/major-projects-groundwater-guidelines>).
- Guidelines for instream works on waterfront land (DPE, 2022).
- Waterfront Land e-tool (NRAR, 2020).
- NSW Water Quality and River Flow Objectives.
- Australian and New Zealand fresh and marine water quality guidelines (ANZG 2018).
- Managing Urban Stormwater: Soils & Construction Volume 1 (Landcom 2004), Volume 2A, 2C and 2D (DECC, 2008).
- Renewable Energy Planning Framework (DPHI, 2024) and Large-scale Solar Energy Guideline (DPHI, 2022).
- Guidelines for Controlled Activities on Waterfront Land (DPI, 2018).
- Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI, 2003).
- Policy & Guidelines for Fish Habitat Conservation & Management (DPE, 2013).

1.2.1 SEARs and Agency Advice

The relevant Planning Secretary's Environmental Assessment Requirements (SEARs) and regulatory submissions to SEARs, including where each is addressed in this report, are listed in Table 1.1 and Table 1.2.

TABLE 1.1: SEARS AND WHERE ADDRESSED

SEAR	Issue	Section addressed in this report
Water and Soils	An assessment of the likely impacts of the development (including flooding and flood modelling) on surrounding watercourses (including their Strahler Stream Order), groundwater resources and surface water movements, and measures proposed to monitor, reduce and mitigate these impacts including water management	Section 5 Surface Water Impact Assessment Section 7 Mitigation and Management Measures
	A site water balance for the development	Section 3.1 Water Balance
	Details of water requirements and supply arrangements for construction and operation (including consultation with suppliers)	Section 3.1.1 Water Demands Section 3.1.2 Water Supply
	A description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with <i>Managing Urban Stormwater: Soils & Construction</i> (Landcom, 2004) and <i>Managing Urban Stormwater: Soils and construction – Volume 2A manual</i> (Landcom, 2008)	Section 5.3 Erosion and Sedimentation
	Assessment of the impacts of the development on hydrology and groundwater (if extraction or interference is proposed), including any changes to overland flows and groundwater levels on-site or off-site, and detail design solutions and operational procedures to manage impacts	Section 4 Flood Modelling Groundwater has not been assessed as part of the SWIA as: • The Project does not propose to extract groundwater. • The depths required for infrastructure footings are insignificant not anticipated to interact with the underlying groundwater table.
	Where the project involves works within 40 metres of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the <i>DPI Guidelines for Controlled Activities on Waterfront Land</i> (2018) and (if necessary) <i>Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings</i> (DPI 2003), and <i>Policy & Guidelines for Fish Habitat Conservation & Management</i> (DPE, 2013).	Section 5.1.2 Waterfront Land
	Identification of any flood risk on site having regard to adopted flood studies, the potential effects of climate change and any relevant provisions of the NSW Flood Risk Management Manual; - where the development could alter flood behaviour, affect flood risk to the existing community or expose its users to flood risk, provide a flood impact and risk assessment (FIRA) prepared in accordance with the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01; - detailed design solutions and operational procedures to mitigate flood risk where required.	Section 4 Flood Modelling Section 5.1.3 Flooding (Impacts) Detailed design to be undertaken post-approval.

TABLE 1.2: REGULATORY SUBMISSION TO SEARS AND WHERE ADDRESSED

Regulator	Reference and Issue	Section addressed in this report
DCCEEW Water Group – Water Take and Licensing	A detailed and consolidated site water balance.	Section 3.1 Water Balance
	Description of all works/activities that may intercept, extract, use, divert or receive surface water and/or groundwater. This includes the description of any development, activities or structures that will intercept, interfere with or remove groundwater, both temporary and permanent.	Section 5 Surface Water Impact Assessment. Groundwater has not been assessed as part of the SWIA as: • The Project does not propose to extract groundwater. • The depths required for infrastructure footings are insignificant not anticipated to interact with the underlying groundwater table.
	Details of all water take for the life of the project and post closure where applicable. This is to include water taken directly and indirectly, and the relevant water source where water entitlements are required to account for the water take. If the water is to be taken from an alternative source confirmation should be provided by the supplier that the appropriate volumes can be obtained.	Section 3.1.2 Water Supply
	Details of Water Access Licences (WALs) held to account for any take of water where required, or demonstration that WALs can be obtained prior to take of water occurring. This should include an assessment of the current market depth where water entitlement is required to be purchased. Any exemptions or exclusions to requiring approvals or licenses under the <i>Water Management Act 2000</i> should be detailed by the proponent.	Section 2.7.4 Existing Local Water Sources. Section 3.1.2 Water Supply
DCCEEW Water Group – Water Impacts	A description of groundwater conditions that provides an understanding of groundwater level across the site under a range of wet and dry conditions.	Groundwater has not been assessed as part of the SWIA as: • The Project does not propose to extract groundwater. • The depths required for infrastructure footings are insignificant not anticipated to interact with the underlying groundwater table.
	Assessment of impacts on surface and ground water sources (both quality and quantity) including flooding, related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, groundwater dependent ecosystems, and ground water levels; including measures proposed to reduce and mitigate these impacts.	Section 3 Proposed Water Management Section 5 Surface Water Impact Assessment Section 7 Mitigation and Management Measures
	Proposed surface and groundwater monitoring activities and methodologies	To be detailed in the ESCP and CEMP for the Project.
	A description of the watercourses located within the vicinity of the development, including Strahler Stream Order as mapped by Spatial Services NSW, and appropriate riparian setbacks. Impact assessment of all works/activities located on waterfront land as defined by the Water Management Act 2000, including an assessment against the Guidelines for Controlled Activities.	Section 2.2 Surface Water Context
	A description of erosion and sediment control measures to mitigate any impacts.	Section 5.3 Erosion and Sedimentation

Regulator	Reference and Issue	Section addressed in this report
DCCEEW Water Group – Assessment against Policy and Guidelines	Identification and impact assessment of all works/activities located on waterfront land including an assessment against Guidelines for Controlled Activities on Waterfront Land (NRAR 2018).	Section 5.1.2 Waterfront Land
	Assessment of project against relevant policies and guidelines, including: Water Sharing Plans, Floodplain Management Plans, NSW Aquifer Interference Policy, Guidelines for instream works on waterfront land (DPE, 2022), Groundwater Guidelines.	Section 2.7 Water Regulatory Framework Section 5.1.2 Waterfront Land
DCCEEW BSC – Flood Risk Management	The EIS must map the following features relevant to flooding as described in the Flood Risk Management Manual: the policy and manual for flood liable land (NSW Government 2023) including: (a) Flood prone land. (b) Flood planning area, the area below the flood planning level. (c) Hydraulic categorisation (floodways and flood storage areas). (d) Flood hazard.	Section 4 Flood Modelling Appendix B: Existing Condition Flood Model Results
	The EIS must describe flood assessment and modelling undertaken in determining design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or an equivalent extreme event.	Section 4 Flood Modelling Appendix A: Hydraulic Model Basis of Modelling
	The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios: (a) Current flood behaviour for a range of design events as identified in 7 above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.	Section 4.3.4 Climate Change Assessment Appendix B: Existing Condition Flood Model Results
	Modelling in the EIS must consider and document: (a) Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies. (b) The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood. (c) Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other development or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories. (d) Relevant provisions of the Flood Risk Management Manual: the policy and manual for flood liable land (2023).	Section 4 Flood Modelling Section 5.1.3 Flooding (Impacts)

Regulator	Reference and Issue	Section addressed in this report
	The EIS must assess the impacts on the proposed development on flood behaviour, including: (a) Whether there will be detrimental increases in the potential flood affection of other properties, assets and infrastructure. (b) Consistency with Council Floodplain Risk Management Plans. (c) Consistency with any Rural Floodplain Management Plans. (d) Compatibility with the flood hazard of the land. (e) Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land. (f) Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site. (g) Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses. (h) Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council. (i) Whether the proposal incorporates specific measures to manage risk to life from flood. These matter are to be discussed with the SES and Council. (j) Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or equivalent extreme flood event). These matters are to be discussed with and have support of Council and the SES. (k) Any impacts the development may have on the social and economic costs to the community as consequence of flooding.	Section 4.3 Existing Flood Behaviour Section 4.4 Developed Flood Behaviour Section 5.1.3 Flooding (Impacts) Appendix B: Existing Condition Flood Modelling Results Appendix C: Developed Condition Flood Modelling Results

1.2.2 Large-scale Solar Energy Guideline

The Large-scale Solar Energy Guideline (DPHI, 2022) (Solar Energy Guideline) provides clear and consistent guidance on how to measure and assess key environmental impacts of large-scale solar energy projects in NSW, declared as SSD. While the Project is not a solar energy project, the guideline is still considered relevant as the Romani BESS constitutes large-scale electricity infrastructure that could be used to support solar energy projects. Key assessment issues covered by the Solar Energy Guideline include:

- Landscape and visual impacts.
- Agricultural land use.
- Infrastructure contributions, benefit sharing and agreements.
- Waste management and circular design.
- Decommissioning and rehabilitation.

Several other assessment issues related to water resources are also identified in Section 5.7 of the Solar Energy Guideline for careful consideration. Table 1.3 lists the considerations relevant to this assessment and where each is addressed in this report.

TABLE 1.3: SOLAR ENERGY GUIDELINE REQUIREMENTS RELEVANT TO WATER RESOURCES

Issue	Assessment	Section addressed in this report
Water Management	Surface water-related impacts, such as flooding, discharge/run-off and erosion, must be assessed. Appropriate mitigation measures, such as sediment controls, must be proposed where warranted.	Section 5.1.3 Flooding Section 5.3 Erosion and Sedimentation Section 7 Mitigation and Management Measures
	Applicants should consult with landholders regarding potential surface water related impacts of the project on neighbouring properties and any mitigation measures.	Section 5 Surface Water Impact Assessment Note: no significant impacts on neighbouring properties which require consultation with adjacent landholders.
	Any assessment of surface water-related impacts must be informed by a soil survey that considers the potential for erosion.	Refer to EIS Section 2.5 Soils and Land Use
	If there is any water take associated with the project, the applicant should identify the source of water (both potable and non-potable) and may need to acquire water access licences if the project is approved.	Section 2.7 Water Regulatory Framework Section 3.1.2 Water Supply
Cumulative Impacts	Any cumulative impacts from any other developments (proposed, approved and operative), especially biodiversity, socio-economic and construction traffic impacts must be assessed in accordance with the department's Cumulative Impact Assessment Guidelines for State Significant Projects (July 2021, or its latest version).	Section 6 Cumulative Impacts

1.3 Project Description

The Project is located adjacent to Booororban-Tchelery Road, Booororban NSW. The Project is wholly located within the Edward River Council Local Government Area (LGA). The Project Area is approximately 21 ha and is comprised of land used for agricultural activities such as livestock grazing.

The Project involves the construction, operation, and decommissioning of a BESS, and associated infrastructure.

The Project comprises of:

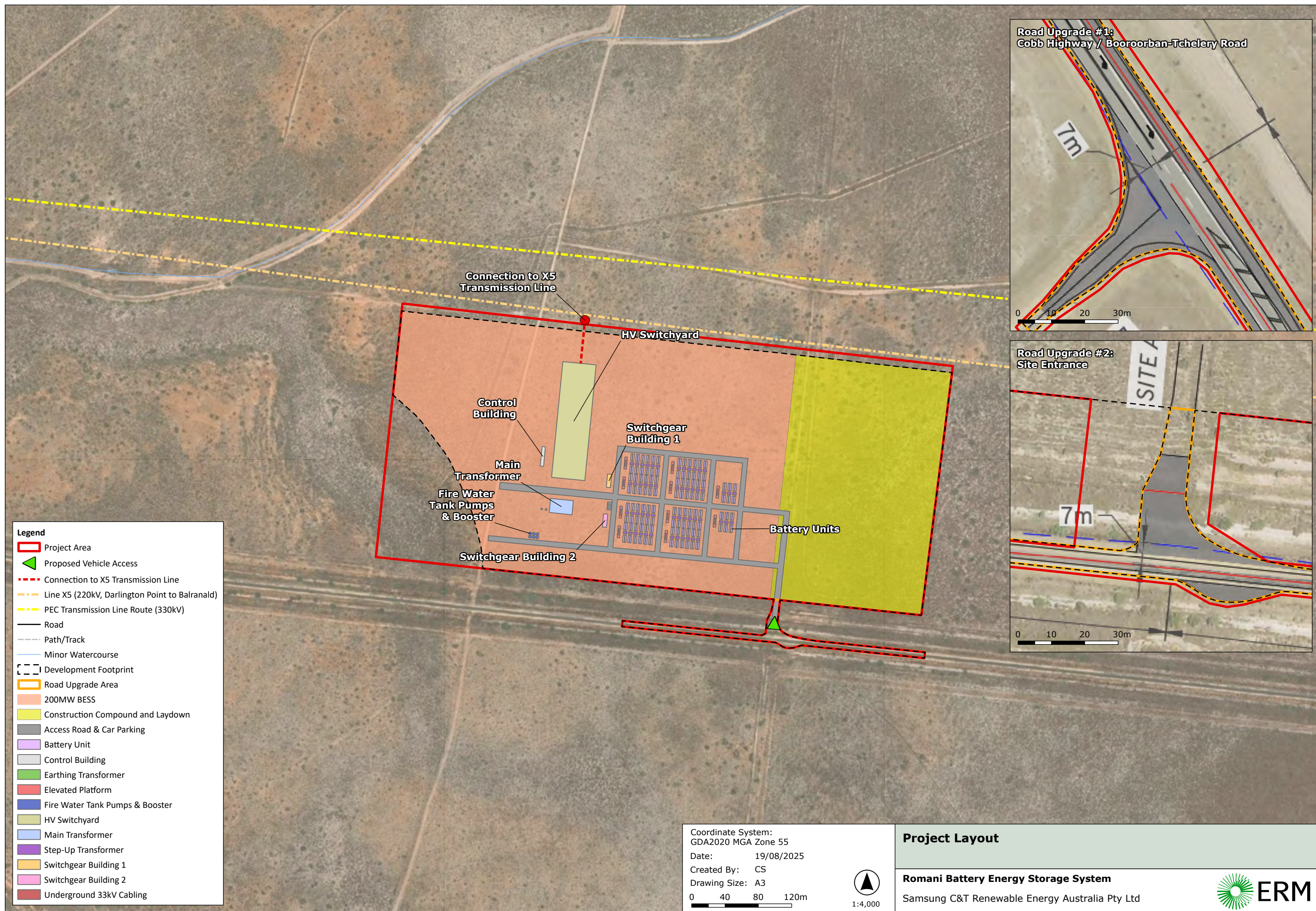
- Lithium-ion BESS with a storage capacity of 200 MW / 800 MWh.
- Electrical reticulation network that is comprised of a 220 kV substation and grid connection to the existing X5 transmission line.
- 220 kV power transformer with a height of approximately 6 m.
- Permanent O&M compound, control building / control room, switch room with a height of approximately 5 m.
- Landscaping works, asset protection zones, access tracks, drainage.
- Vehicle access to/from Booororban-Tchelery Road, including road upgrades at the intersection of Booororban-Tchelery Road and Cobb Highway
- Construction period: 18 months.
- Construction workforce (peak): 80-100 Full Time Equivalent (FTE).
- Construction workforce (average): 30-50 FTE.
- Operational workforce: 3-5 FTE.

An overview of the Project layout is provided in Figure 1.1.

1.4 Project Terminology

TABLE 1.4: PROJECT TERMINOLOGY

Term	Definition
Project	A BESS as described in Section 1.3 to which the Application applies.
Project Site	Red dashed boundary shown on key figures to which the Application applies (unless otherwise stipulated) and does not include external road upgrades
Project Area	Includes the Project Site and external road upgrades as shown by the solid red boundary on Figure 1.1.
Applicant	Samsung C&T Renewable Energy Australia Pty Ltd
Application	Application for Development Consent under Part 4.7 of the EP&A Act; and Determination under Part 9 of the EPBC Act



2. BASELINE CHARACTERISTICS

2.1 Climate

The Murrumbidgee Region is characterised as a semi-arid climatic zone, with rainfall typically occurring through winter and spring, and less likely during summer and autumn. The arid climate conditions reflect the lowland topography that experiences hot summer temperatures and moderate winter rainfall, varying annually. The local climate is conditioned as generally dry, evidently observed through Digital Earth Australia (DEA) Water Observation Landsat data. The majority of wet periods are recorded through April to October, although ponding is not commonly observed over the Project Area, apart from within natural waterbodies.

Four Bureau of Meteorology (BoM) operated long-term weather stations surround the Project Area and are listed in Table 2.1. SILO grid data (time series of daily data including observed and interpolated data from 1889 to present) has been taken from the datapoint located closest to the centre of the project footprint (-34.90 latitude, 144.55 longitude) to represent the rainfall and evaporation data for the site.

There is some variation in average daily rainfall between each of the gauging stations and the SILO datapoint. However, given the distance from the Project, the observed variation is relative to the expected natural variation over the landscape, and the SILO dataset is considered suitable to be used to represent long-term rainfall data for the Project Area. Evaporation data obtained from the SILO database is based on using a Class A evaporation pan which indicates the amount of water evaporating from bare ground or open water. The rate of evaporation depends on factors such as cloudiness, air temperature and wind speed.

The average monthly rainfall and pan evaporation within the Project Area are presented in Figure 2.1, indicating that monthly evaporation consistently exceeds monthly rainfall. Evaporation is exceptionally higher than rainfall during the summer months, with values during June and July being lowest and most similar to rainfall. This reflects the seasonal change into winter which demonstrates slightly higher rainfall than the rest of the year.

TABLE 2.1: NEARBY WEATHER STATIONS AND SILO DATAPOINT

Station	Approximate proximity to Project Area	Data Range
Wanganella (Bundyulumbah) (75081)	22 km	1984-present
Booroorban (Ramsay) (75056)	15 km	1928-2017
Hay Airport AWS (75019)	43 km	2007-present
Moulamein (Tchelery) (75062)	39 km	1936-present
SILO Grid Data	Project Area	1889-present

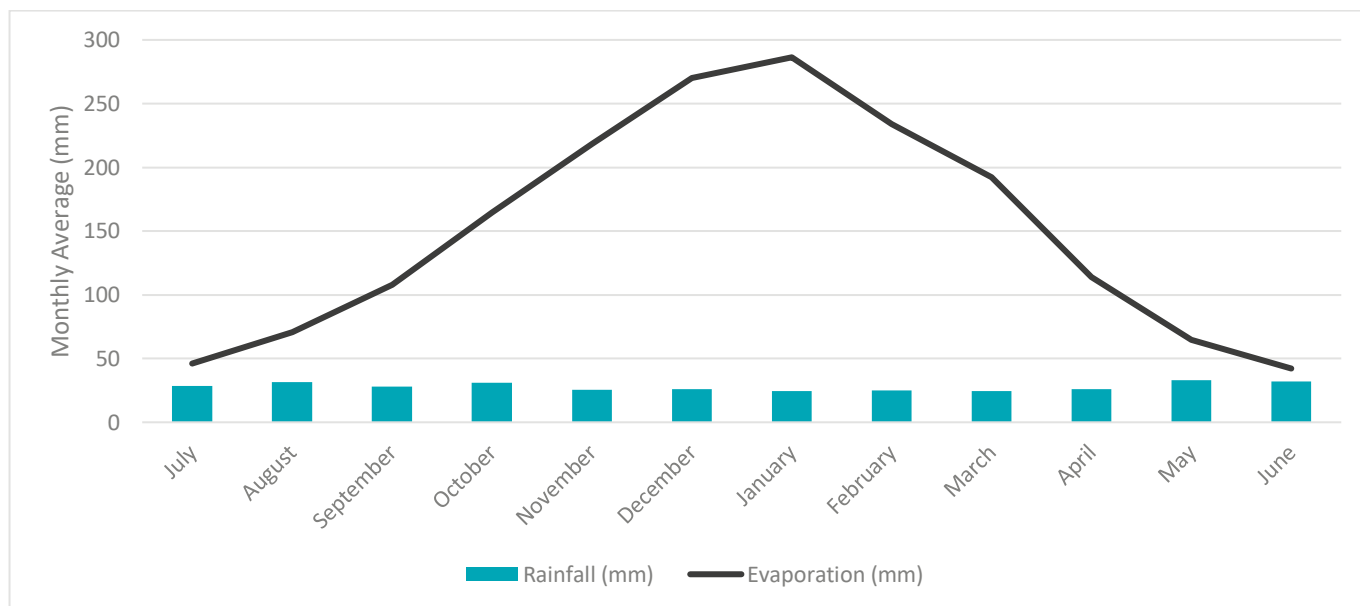


FIGURE 2.1: AVERAGE MONTHLY RAINFALL AND PAN EVAPORATION WITHIN THE PROJECT AREA – DERIVED FROM SILO DATA

2.2 Surface Water Context

2.2.1 Regional Systems

The Project is located within the Edward River LGA and the Murrumbidgee catchment area as part of the broader Murray Darling catchment. A tributary to the Murray River, the Murrumbidgee River flows in a south-westerly direction lying approximately 37 km north of the northern Project Area boundary. The Lower Murrumbidgee Floodplain (Lowbidgee) is home to the largest remaining area of intact wetlands in the Murrumbidgee region. The Lowbidgee is located between Maude and Balranald and approximately 50 km to the north-west of the Project Area. The floodplains are not influenced by the key watercourses flowing through or adjacent to the Project Area.

Potential connectivity between the Murrumbidgee River and the Project Area is likely via numerous diverting anabranches and flood runners from the Murrumbidgee River, such as the ephemeral The Forest Creek, located approximately 700 m from the Project.

The Forest Creek is a 9th order stream, located around 700 m south-east of the Project Area boundary, which flows into the Coleambally Outfall Drain approximately 10 km south-east of the Project Area. As the site is located within the Murrumbidgee floodplain, it is anticipated that during an event which engages the Murrumbidgee River, flows will breakout of the river and could engage the surrounding floodplain, potentially impacting these waterways.

Abercrombie Creek is the only other watercourse within close proximity to the Project Area, with a stream order of 9, located approximately 10 km north of the site, and flowing west to east and draining into Gum Creek before the Murrumbidgee River. The Forest Creek located south of the Project Area connects to Abercrombie Creek approximately 60 km northeast of the Project Area via Nyangay Creek and Curtains Creek.

The Project Area is located approximately 44 km south-west of Hay, and 15 km north-west of the Boorooban village. The landscape is largely flat, dominated by floodplains and a network of ephemeral flow paths. The Project Area is located within the Coleambally Irrigation Co-Operative Limited (CICL) West Coleambally Management Area with the Coleambally Outfall Drain which flows in a westerly direction located south of the Project Area. The West Coleambally Management Area spans an area of approximately 30,000 ha and provides irrigation to nearly 500 farms. The water supply in the area is via an open, gravity fed channel network.

The South West Woodland Nature Reserve is located approximately 20 km to the south-east of the Project Area, upslope of the Project.

An overview of the Project Area and its proximity to key regional drainage features is provided in Figure 2.2.

2.2.2 Local Systems

The SWIA focus on the potential impacts associated with the Project Site, which contains surface level elevations typically ranging from approximately 80 mAHD to 82 mAHD (refer to Figure 2.3).

The local drainage systems within and surrounding the Project Site are not well defined due to the generally flat topography and established agricultural land use activities. Existing agricultural dams likely influence flow regimes within and surrounding the Project Site with runoff being captured in these dams during flow events.

The topography of the Project Site has slight variations in relief, with watershed in both southwestern and southeastern flow directions.

All mapped “defined” watercourses within the Project Site have been identified from the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) published hydroline dataset (2018). There are no non-minor Strahler classification watercourses mapped within the Project Site.

The *Harvestable Rights (central inland-draining catchments) Order 2022* under the *Water Management Act 2000* defines a minor stream as:

- (l) *any stream or part of a stream:*
 - (i) *identified as a watercourse in the hydroline spatial data, and*
 - (ii) *that is a first or second order stream, or part of such a stream, determined in accordance with the Strahler system set out in Schedule 2 to the Water Management (General) Regulation 2018, and*
 - (iii) *that does not maintain a permanent flow of water, being a visible flow which occurs on a continuous basis, or which would so occur if there were no water extractions, diversions or obstructions of flows upstream, and*
- (m) *any stream or part of a stream which is not identified as a watercourse in the hydroline spatial data.*

There are no stream hydrolines mapped within the wider Project Area, with one unnamed mapped ephemeral waterbody located within the south-western corner of the Project Site (refer to Figure 2.3).

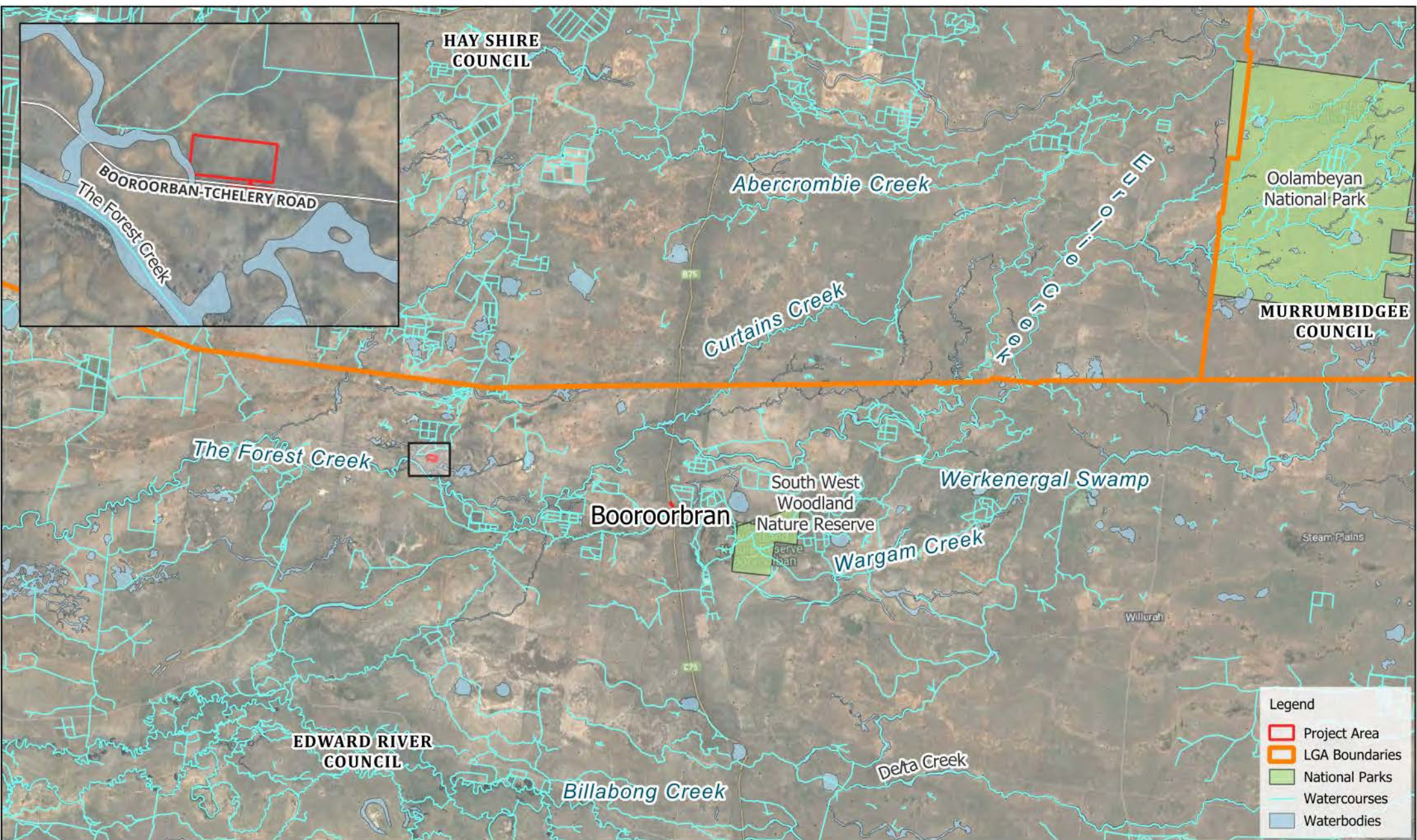
Existing irrigation drains are mapped surrounding the Project Site, supporting previous agricultural land uses. These irrigation drains typically do not interact with defined watercourses and are considered to have an undefined Strahler classification, in accordance with NSW Web mapping tools (Mitry, 2020).

Characterising the local drainage catchments and flow paths within the Project Site is difficult given the typically flat topography and localised natural depressions. General flow directions were determined using a 5 m Digital Elevation Model (DEM), sourced from NSW Government Spatial Services (dated December 2011), and mapped hydrolines.

2.2.3 Waterfront Land

Waterfront land is defined as any river, lake or estuary, and the land within 40 m of the riverbanks, lake shore or estuary mean high-water mark (NRAR, 2020). Waterfront land exists for any watercourse or lake with a defined bed and bank and for any third order or above mapped hydroline. An assessment of waterfront land was undertaken using the NSW Government hydroline spatial data (2018) and LiDAR survey data acquired from NSW Government Spatial Services (2011).

One mapped hydroarea (waterbody) is located within the Project Site and no mapped watercourses (i.e. Strahler classified). The mapped hydroarea is a natural waterbody with defined features and therefore was assessed as having waterfront land. Areas mapped as waterfront land are shown in Figure 2.3. All proposed Project infrastructure is located outside of the mapped waterfront land.



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SCALE @ A4 - 1:350,000
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DATA SOURCE

NSW Government Open Data Source


ENGENY



Romani BESS

Figure 2.2: Regional Drainage Overview

Drg Ref.: BNTL00206_007-FIG-001

Revision: 1



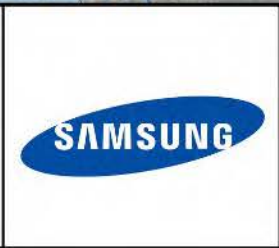
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DATA SOURCE
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Romani BESS

Figure 2.3: Local Drainage and Elevation Overview

Drg Ref.: BNTL00206_007-FIG-002

Revision: 1

2.3 Flooding

2.3.1 Approach

An assessment of flooding regimes within the Project Site has been undertaken, in accordance with the methodology described in Section 4 and Appendix A. This included:

- Review of available nearby flood studies and riverine influence from the Murrumbidgee River.
- Development of a regional rain-on-grid (RoG) TUFLOW model to determine potential upstream inflows.
- Development of a local TUFLOW model, with runoff for the Project Site determined using a RoG approach and upstream flows provided from the regional model.
- Simulation of design flood events for the 5%, 1%, 0.5% and 0.2% AEP and Extreme Flood Event (defined as three times the 1% AEP), to determine flood behaviour through the Project Site.

2.3.2 The Murrumbidgee River Influence

The Project Site is situated within the Murrumbidgee River floodplain, specifically located 35 km south of the river. As the site is located within the floodplain, it is anticipated that during an event which engages the Murrumbidgee River, flows will breakout from the river and could engage the surrounding floodplain, potentially impacting the site.

The Murrumbidgee breakout has been documented in previous EISs prepared for solar farms located on the Murrumbidgee floodplain, such as *The Plains Wind Farm Environment Impact Statement Technical Paper: Flooding*, ref. GO583 Rev 1.3 (Lyll & Associates, 2024). This investigation identified that The Plains Wind Farm, which is located approximately 30 km north-east of the Project Site, is subject to riverine flooding when an event occurs within the Murrumbidgee River, due to flows breaking out of the Murrumbidgee River between Narrandera and Darlington Point, for the 1% AEP and Probable Maximum Flood (PMF) events. However, The Plains study also investigated the impacts of local flooding, due to direct rainfall on the catchment upstream of The Plains Wind Farm and determined that local flooding resulted in the worst-case flooding conditions for the floodplain. Due to the relative difference in catchment size between the Murrumbidgee River at Darlington Point (~38,000 km²) and the local catchment of the Project Site (~7,500 km²), it is considered unrealistic to assume both systems would receive a 1% AEP or PMF event at the same time and therefore coincident flooding with the Murrumbidgee River has not been assessed, as the chance of this occurring is deemed to be extremely rare.

As such, the hydrology and flooding assessment for this EIS excludes the detailed investigation of riverine flooding due to the Murrumbidgee River, as it is understood that the local contributing catchment plays a more significant role in impacts to the floodplain. Impacts of riverine flooding would be considered during post approval and, if required, can be incorporated for the detailed design of the site infrastructure and the Emergency Response Plan.

2.3.3 Existing Flood Behaviour

Detailed mapping of flood conditions including depth, velocity and hazard is provided in Appendix B for the Project baseline conditions (i.e. existing land uses). The existing flood behaviour is discussed in detail in Section 4.3 and impacts predicted with the Project are detailed in Section 5.1.3.

The adopted modelling approach and modelled flood behaviour are discussed in Section 4. The existing conditions flood modelling results indicate that due to the typically flat topography within and surrounding the Project Site, the site is inundated in all scenarios by overland sheet flow from the local catchment. This sheet flow is typically slow and shallow moving. There is also one defined flow path along the eastern site boundary, with flood depths and velocities within the site boundary generally remain below 0.6 m and 0.3 m/s, respectively, in the 0.2% AEP event.

2.4 Water Quality and Flow Regimes

2.4.1 Water Quality and River Flow Objectives

The NSW Water Quality and River Flow Objectives (as published by the then Office of Environment and Heritage (OEH)) are the agreed environmental values and long-term goals for NSW surface waters (OEH, 2006). The objectives consist of the NSW Water Quality Objectives (WQOs) and the NSW River Flow Objectives (RFOs), which aim to achieve the right water quality for different land uses and improve environmental results from managing the riverine system.

The Project Site exists within the Murrumbidgee & Lake George Catchment, and consists of areas with the following classifications:

- Uncontrolled streams - applies to uncontrolled waterways that are not in the other categories. The flow patterns of these streams are largely natural.
- Waterways affected by irrigation drainage - applies to natural and semi-natural waterways whose flows are now dominated for substantial periods by irrigation drainage. Flow and water quality are therefore largely unnatural.

The different WQOs and RFOs relevant to the project are detailed in Sections 2.4.2 and 2.4.4.

2.4.2 Water Quality Objectives

The NSW WQOs are consistent with the agreed national framework for assessing water quality as set out in the Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality (ANZG, 2018). The WQOs most applicable to the Project are associated with aquatic ecosystems and are summarised in Table 2.2.

The ANZG default guideline values for Lowland Rivers (i.e. < 150 mAHD) in south-east Australia provide guidance on acceptable levels (trigger values) of key water quality indicators associated with the Project.

TABLE 2.2: RELEVANT NSW WATER QUALITY OBJECTIVES – MURRUMBIDGEE CATCHMENT

Objective	Indicator	Guideline / Trigger Value	Applicability to the Project
Aquatic Ecosystems - <i>Maintaining or improving the ecological condition of waterbodies and their riparian zones over the long term.</i>	pH	6.5 to 8.5	High Relevance – One mapped waterbody within the Project Area which is classified as mainly dry (NSW Gov), with flows in higher rainfall conditions. Potential interaction with non-perennial The Forest Creek. The area therefore has the potential to support aquatic ecosystems and WQOs should be met.
	Total phosphorus (TP)	50 µg/L for rivers in the Murray-Darling Basin	
	Total nitrogen (TN)	500 µg/L for rivers in the Murray-Darling Basin	
	Chlorophyll-a	5 µg/L	
	Turbidity	6 to 50 NTU	
	Salinity (electrical conductivity) (EC)	125 to 2200 µS/cm	
	Dissolved oxygen (DO)	85 to 110%	

Additionally, Managing Urban Stormwater: Soils and Construction Volume 1 (the 'Blue Book') (Landcom, 2004), Volume 2A Installation of services (DECC, 2008) and Volume 2C Unsealed roads (DECC, 2008) provide guidance on acceptable practice in NSW to mitigate the impacts of land disturbance activities (involving changes in land uses from rural, open space or bushland settings to other forms) on soils, landforms and receiving waters by focussing on erosion and sediment control. The Blue Book provides guidance on typically accepted total suspended solids (TSS) to be < 50 mg/L.

Toxicant default guideline values for protecting aquatic ecosystems were published by ANZG in 2018. A summary of the default guideline values (DGVs) for metals/metalloids in freshwater are included in Table 2.3 for differing levels of species protection (LOSP) (%), including:

- high ecological/conservation value system – 99% species protection DGV.
- slightly to moderately disturbed system – 95% species protection DGV.
- highly disturbed system – 90% or 80% species protection DGV.

The Project Site and downstream watercourses are assumed to be 'slightly to moderately disturbed systems' due to agricultural activities, which, in accordance with the ANZG, are ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity. For example, rural streams receiving runoff from land disturbed to varying degrees by grazing or pastoralism. It is therefore assumed that the 95% LOSP is relevant to the Project.

TABLE 2.3: TOXICANT DEFAULT GUIDELINE VALUES

Toxicant name	Tox LOSP 95	Tox LOSP Unit
Aluminium (pH >6.5)	55	µg/L
Arsenic (AsIII)	24	µg/L
Arsenic (AsV)	13	µg/L
Boron	940	µg/L
Cadmium	0.2	µg/L
Chromium (CrVI)	1	µg/L
Copper	1.4	µg/L
Lead	3.4	µg/L
Manganese	1900	µg/L
Mercury (inorganic)	0.6	µg/L
Nickel	11	µg/L
Selenium (total)	11	µg/L
Silver	0.05	µg/L
Zinc	8	µg/L

Additionally, the Murray Darling Basin Authority (MDBA) aims to prioritise proper management of salinity. The Basin Salinity Management 2030 strategy (BSM2030), which has been in place since 2015, has the following focus listed on the MDBA website:

- Maintain the cap on salinity through the existing Basin Salinity Target and the existing accountability framework.
- Bring environmental water fully into the accountability framework in a practical and pragmatic way.
- Explore opportunities to responsively manage salt interception schemes so that operations can be further optimised and costs can be reduced when River salinity is forecast to be low.
- Support Basin Plan flow management obligations to have regard to the salinity targets for managing water flows.
- Support basin states managing salinity in their catchments through their land and water management plans and be consistent with their Basin Plan water resource plan obligations.
- Develop fit-for-purpose governance arrangements which reduce the frequency of audit, reporting and reviews.
- Invest in knowledge to reduce uncertainty and potentially avoid the need for future capital investment in new joint works and measures.
- Undertake a major strategic review to ensure the strategy continues to guide effective management of salinity in the basin.

Specific elements of the BSM2030 (i.e. mandatory elements) have been incorporated into Schedule B to the Murray–Darling Basin Agreement – Schedule 1 to the *Water Act 2007* (Commonwealth).

As part of the BSM2030 there are river and end-of-valley salinity targets that are required to be met by the NSW, Victoria and South Australia governments.

2.4.3 Background Regional Surface Water Quality

The State of the Catchments (SOC) 2010 Riverine Ecosystems reports developed by the Department of Environment, Climate Change and Water NSW (DCCEEW NSW) in 2010 provide a holistic water quality report for the 84,000 km² Murrumbidgee Catchment, assessing the water quality condition and trend. The SOC's for the Murrumbidgee and Murray regions have been reviewed to provide an understanding of existing surface water quality surrounding the Project (DCCEEW NSW, 2010).

The SOC's describe water quality condition as the percentage of samples exceeding the ANZECC / ANZG water quality guidelines for turbidity and total phosphorus. Additionally, fish, macroinvertebrates, and hydrology are used to indicate water quality condition, and trend based on the Sustainable Rivers Audit (SRA).

Water quality findings relevant to the Project Site within the Murrumbidgee River and Murray River catchments were recorded at the following locations:

- Murrumbidgee Region:
 - Downstream Hay Weir offtake location, north of the Project. This site represents water quality within the Murrumbidgee River in an area with no potential impact by the Project.
 - Gogeldrie Weir, north-west of the Project. This site represents the water quality downstream of an area that potentially receives breakouts from the Murrumbidgee River in extreme events, inclusive of the Project and nearby waterbodies.
- Murray Region:
 - Wakool River at Kyalite, approximately 150 km downstream of the Project. This site represents water quality in downstream reaches of Wakool River (a tributary of the Murray River) in which the South West REZ and the Project are located.

A summary of the guideline values for phosphorus and turbidity at a lowland site (altitude < 150 mAHD) and results from the SOC's are summarised in Table 2.4.

TABLE 2.4: STATEMENT OF CATCHMENTS WATER QUALITY RESULTS

Location	Catchment	Total Phosphorus - Guideline Value (mg/L)	Percentage of Results Exceeding Guideline Value (%)	Turbidity - Guideline Value (NTU)	Percentage of Results Exceeding Guideline Value (%)
Murrumbidgee River D/S Hay Weir	Murrumbidgee	0.05	10%	50	9%
Murrumbidgee River at Gogeldrie Weir	Murrumbidgee	0.05	16%	50	9%

Further, the waterway health was characterised by data recorded for aquatic biota including fish and macroinvertebrates. Macroinvertebrate data indicates that the Project Area is in moderate condition, however fish data suggests it to contain poor to very poor conditions due to low nativeness of the fish species within this area.

The Murrumbidgee Water Resource Plan Area (WRPA) provides insight into the water quality within the catchment area, indicating that the water quality ranges from poor to excellent. The downstream Hay Weir offtake from the Murrumbidgee River is suggested to have a fair water quality index.

Findings indicate that the Murrumbidgee Catchment relevant to the Project regularly exceeds guideline values for total phosphorus and turbidity.

2.4.4 River Flow Objectives

The River Flow Objectives (RFOs) with high relevance to the Project are summarised in in Table 2.5.

TABLE 2.5: RELEVANT NSW RIVER FLOW OBJECTIVES – MURRUMBIDGEE CATCHMENT

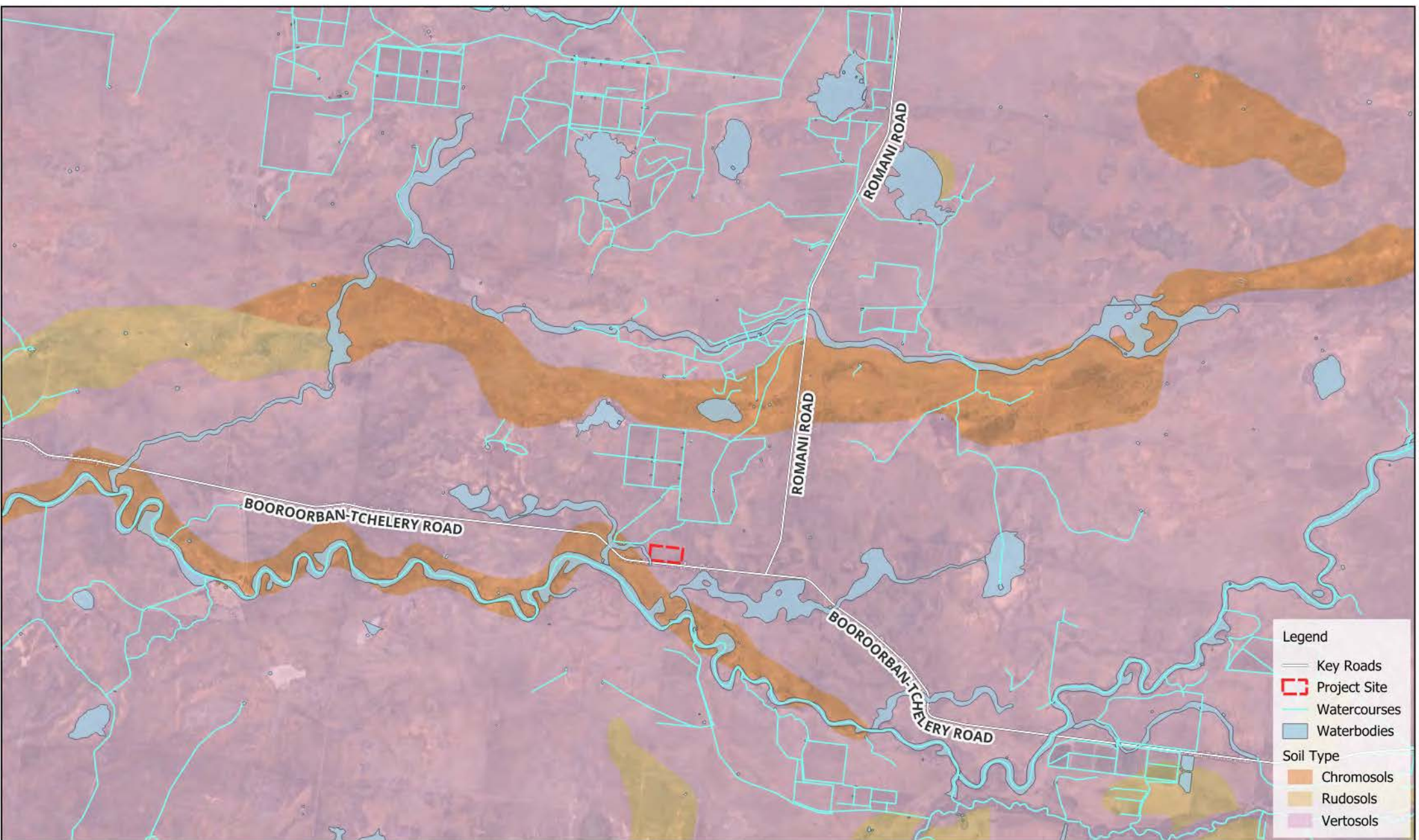
Objective	Description	Measures to achieve objective	Applicability to the Project
Protect pools in dry times - <i>Protect natural water levels in pools of creeks and rivers and wetlands during periods of no flows</i>	During dry times, some streams stop flowing and form pools. Pools and wetlands are refuges for aquatic plants and animals. Pumping water from these areas can make it more difficult for many species to recover after a drought.	- There should be no water extraction from streams or wetlands in periods of no flow. - If conditions on water licences do not provide for this objective to be met, priority should be given to implementing it by actions appropriate to local circumstances.	High Relevance – the Project Area is located across a generally flat topography that contains arid conditions, with low rainfall and high evaporation rates. Pools are likely to occur during flood conditions, however, dry up relatively quickly due to high evaporation and infiltration rates.
Protect natural low flows - <i>Protect natural low flows</i>	Water extraction and storage are high in dry times and impose long artificial droughts that increase the stress on aquatic plants and animals.	- Share low flows between the environment and water users and fully protect all very low natural flows. - Very low flows: flows below the level naturally exceeded on 95% of all days with flow. - Low flows: flows below the level naturally exceeded on 80% of all days with flow. - Unless environmental, social and economic evaluations give an appropriate alternative, the following limits on water extraction apply:	High Relevance – the Project Area is located upon a generally flat topography that contains minimal landscape formations. The Murrumbidgee Catchment area experiences minimal rainfall. The Project has potential to impact surface water flows in downstream watercourses, which are typically already classified as ephemeral (dry in periods).

Objective	Description	Measures to achieve objective	Applicability to the Project
		– Environmental share in high-conservation-value streams: to be all very low flows and most of the low flows. There should be no increase in extraction of low flows. – Environmental share in other streams: all very low flows and 50-70% of daily low levels. • New or transferred licences should not allow extraction during low flows below the 80th percentile. • In streams with little water use or important conservation values, minimise risks to ecosystems during low flows. • Review management of town water supplies to assess whether changes may help achieve the objective without significantly affecting reliability.	
Maintain natural flow variability - <i>Maintain or mimic natural flow variability in all streams</i>	Australia's rainfall and river flows are naturally variable. The way we currently store and divert river water can reduce natural pulsing of water down rivers and maintain artificially high or stable river heights. Hydro-electric releases can vary unnaturally between day and night. In urban areas and other places where the ability of the land to absorb or detain rainfall is reduced, more water runs off rapidly, so water levels will rise higher. These changes often create problems with streambank stability, biodiversity and signals for breeding and migration.	• Identify streams with unnatural flow variability and develop actions to mimic natural variability. • Identify streams with potential for flow variability problems and take early action.	High Relevance - the Project Area is situated within a catchment area containing a steady flow regime during wet periods due to the generally flat topography with minimal depressions. The Project has potential to impact surface water flows in downstream watercourses, which are typically classified as ephemeral (dry in periods).
Mimic natural drying in temporary waterways <i>Mimic the natural frequency, duration and seasonal nature of drying periods in naturally temporary waterways</i>	Continuous or seasonal water releases from water storages can mean streams and wetlands can sometimes be 'wetter' than natural. In streams and wetlands that naturally dry out, this can create problems in maintaining habitat, vegetation, nutrient cycling and signals for breeding. It can also lead to a high watertable and associated salinity problems. Natural wetting and drying cycles produce diversity of habitat and, therefore, high species diversity.	• Identify any creeks or unregulated rivers where unnatural flows have greatly reduced drying periods. Assess potential short- and long-term environmental, economic and social effects of this change and of possible management alternatives. • Decide what, if any, action is appropriate to implement this objective in streams and wetlands should be worked out on a case-by-case basis after giving due consideration to local views. Where relevant, agreements under land and water management plans should be respected, but this objective should be taken into account, along with WQOs, social objectives and economic objectives, in resolving outstanding or new management issues for drainage water.	High Relevance - the Project Area is situated within a catchment area containing a steady flow regime during wet periods due to the generally flat topography with minimal depressions. The Project has potential to impact surface water flows in downstream watercourses, which are typically classified as ephemeral (dry in periods).

2.5 Soils and Land use

The soil type (in accordance with the Australian Soil Classification) within the Project Site are Vertosols, as shown in Figure 2.4. Vertosols typically have high infiltration potential supporting the well-drained topography characterised by semi-arid conditions. While the Project Site does not lie within a Murrumbidgee Region soil monitoring unit (SMU) it is located nearest to the Boree Plains soil monitoring unit, which contains self-mulching brown vertosols, brown chromosols and sodosols, with arenic rudosols. Wind erosion and soil structure are two limiting indicators of the soils condition with a declining soil condition (DCCEEWSW, 2010).

The Project Site is zoned as Primary Production (RU1) under the *Conargo Local Environmental Plan (LEP) 2013*. The wider area is dominated by agricultural activities, with areas of rural residential land holdings, public roads, nature reserve, access tracks and electricity transmission lines. The region supports native derived vegetation that has predominantly been transformed through the agricultural land use activities (MDBA, 2023). The Southwest Woodland Nature Reserve is located approximately 20 km to the south-east of the Project Site (refer to Figure 2.2).



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Figure 2.4: Soil Classification

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Revision: 1

2.6 Published Studies

The Project Area is located within the southern region of the Murray-Darling Basin, within the Lower Murrumbidgee Catchment and is located within the Edward River Council LGA (refer to Figure 2.2).

2.6.1 Flood Studies

A flood study was prepared by BMT WBM Pty Ltd in 2018 for Murrumbidgee Council to investigate the flood behaviour of the *Murrumbidgee River at Darlington Point and Environs*, north-east of the Project Site. Historically, flooding has occurred within the southern bounds of the Darlington Point catchment area causing extensive damage and disruption. This influences potential inundation throughout the area, where flow regimes and drainage lines direct towards the Project Site.

The model developed for the *Murrumbidgee River at Darlington Point and Environs Flood Study* (BMT, 2018) was updated to inform the *Darlington Point Floodplain Risk Management Study & Plan* (Murrumbidgee Council, 2020). This included extension of the Murrumbidgee River TUFLOW model, a two-dimensional (2D) representation of the channel and floodplain of the Murrumbidgee River floodplain at Darlington Point. The study indicates breakouts from the Murrumbidgee River at Darlington Point, flowing south-west toward the Project Site, in events above the 1% AEP.

This is further supported in *The Plains Wind Farm Environment Impact Statement Technical Paper: Flooding*, ref. GO583 Rev 1.3 (Lyall & Associates, 2024), as discussed in Section 2.2.1. This study also investigated the impacts of local flooding, due to direct rainfall on the catchment upstream of The Plains Wind Farm and determined that this resulted in the worst-case flooding conditions for the floodplain.

2.6.2 Murrumbidgee Management

The Murrumbidgee Alluvium Water Resource Plan was developed as part of the *Murray-Darling Basin Plan 2012* to build on the existing and established water planning and management frameworks in NSW (DPI, 2018). The plan recognises the alteration of the Murrumbidgee River flow regime due to the nearby construction of Burrinjuck Dam, and various structures relating to the Snowy Mountains Scheme. Altering of the watercourse has influenced divergence of the main canals of the Murrumbidgee and Coleambally irrigation areas.

Other published studies in the area are summarised in Table 2.6.

TABLE 2.6: PUBLISHED STUDIES

Source	Dataset(s)	Applicability
<i>Murrumbidgee Local Environment Plan 2013</i>	Riparian Lands and Watercourse Map Sheet Wetlands Map Groundwater Vulnerability Map Coleambally Irrigation Area Map	No interaction with Project
<i>Conargo Local Environmental Plan, 2013</i>	Watercourses Map, Groundwater Vulnerability Map, Wetlands Map	No interaction with Project.
<i>Murray River – Flood Plain Atlas – 1/01/1986</i>	Not available/ Unknown	No interaction with Project Note: study unavailable to download
<i>Murrumbidgee Floodplain Risk Management Study - Undated</i>	Not available/ Unknown	No interaction with Project. Note: study unavailable to download
<i>Water for River Red Gums, 1986</i>	Not available/ Unknown	No interaction with Project Note: study unavailable to download
<i>Water Modelling-Modelled Data Without Development – Murrumbidgee - 2023</i>	Not available/ Unknown	No interaction with Project Note: study unavailable to download

2.7 Water Regulatory Framework

2.7.1 Commonwealth Water Licensing and Approvals

The *Commonwealth Water Act 2007* was developed to manage the Murray-Darling Basin water resources in the national interest in a way to optimise economic, social and environmental outcomes. The Murray-Darling Basin Authority (MDBA) is established by the *Water Act 2007* to prepare and implement the *Commonwealth Basin Plan 2012* (the Basin Plan).

The Basin Plan sets sustainable diversion limits for the Basin as a whole and for each individual water management area, sets water trading rules, and contains an Environmental Watering Plan and a Water Quality and Salinity Management Plan. The Basin Plan covers 1,000,000 km² across NSW, Queensland, Victoria and the Australia Capital Territory. The Basin Plan has the following key elements, which are to be managed under the WRPs:

- Water limits for consumption – managed by setting sustainable diversion limits, and WRPs.
- Water for the environment – environmental water and recovery of water from communities, industries and irrigators to sustain the natural ecosystems of the Murray-Darling Basin.
- Infrastructure development, operation and maintenance – relating to dams, barrages and weirs to regulate water flows and deliver water to communities, irrigators and the environment.
- Managing groundwater – to preserve and improve water quality.
- Maintaining water quality to be suitable for drinking, agriculture, recreation and the environment.
- Water markets and trade – via WRPs.
- Monitoring and enforcing compliance, via the Inspector-General of Water Compliance.
- Monitoring and evaluating the effectiveness of water management, via annual and 5 yearly cycles

2.7.2 Water Resource and Water Sharing Plans

Water Resource Plans (WRP) are a key requirement of the Basin Plan, indicating limits on water take, water for the environment, and how to meet water quality standards. The WRPs rely heavily on the NSW water sharing plans (WSPs) to provide a clear framework and rule-set for managing NSW Basin water resources. The objectives of WRPs and the relationship with the Basin Plan are outlined below and in Figure 2.5.

Overarching Objectives

- *To give effect to relevant international agreements through the integrated management of Basin water resources*
- *To establish a sustainable and long-term adaptive management framework for the Basin water resources, that takes into account the broader management of natural resources in the Murray-Darling Basin*
- *To optimise social, economic and environmental outcomes arising from the use of the Basin water resources in the national interest*
- *To improve water security for all uses of Basin water resources.*

Outcomes

- *Communities with sufficient and reliable water supplies that are fit for a range of intended purposes, including domestic, recreational and cultural use*
- *Productive and resilient water-dependent industries, and communities with confidence in their long-term future*
- *Healthy and resilient ecosystems with rivers and creeks regularly connected to their floodplains and, ultimately, the ocean.*

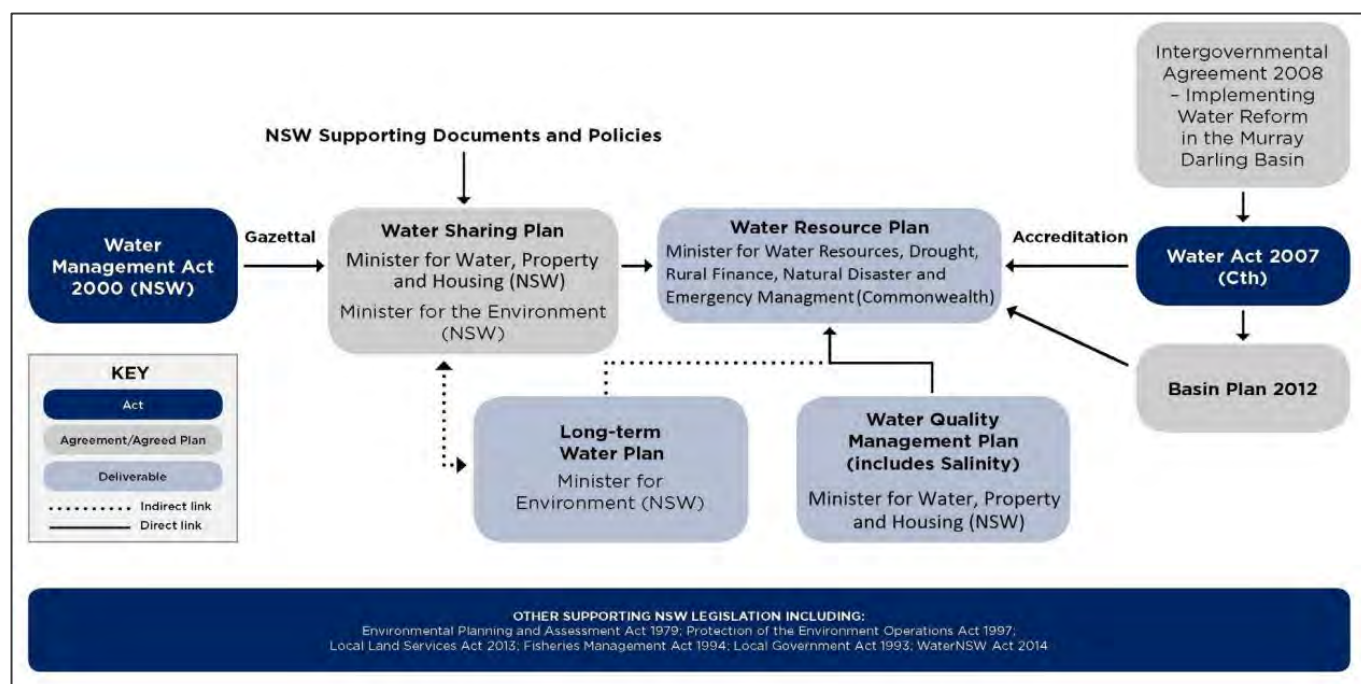


FIGURE 2.5: RELATIONSHIP BETWEEN BASIN PLAN, WRP, AND OTHER INSTRUMENTS

Source: NSW Murray and Lower Darling Surface Water Resource Plan (2024)

The Water Resource and Water Sharing Plans applicable to the Project are summarised in Table 2.7.

TABLE 2.7: APPLICABLE PLAN AREAS

Area / Zone	Plan
Water Resource Plans	
Surface water resource plan area	Murrumbidgee (SW9)
Surface water sustainable diversion limit area	Murrumbidgee (SW9)
Groundwater resource plan area	Murrumbidgee Alluvium (GW9) NSW Murray–Darling Basin Fractured Rock (GW11)
Groundwater sustainable diversion limit area	Lower Murrumbidgee Deep Alluvium (GS28b) Lower Murrumbidgee Shallow Alluvium (GS28a) Lachlan Fold Belt MDB (GS20)
Water quality zone	Lowland – Castlereagh, Lachlan, Macquarie and Murrumbidgee
Water Sharing Plans	
Surface water sharing plan	Murrumbidgee Regulated River Water Source 2016 Murrumbidgee Unregulated River Water Sources 2012
Surface water source	Murrumbidgee Western Water Source
Groundwater sharing plan	Murrumbidgee Alluvial Groundwater Sources 2020 Murray Darling Basin Fractured Rock Groundwater Sources 2020
Groundwater source	Lower Murrumbidgee Deep Groundwater Source Lower Murrumbidgee Shallow Groundwater Source Lachlan Fold Belt MDB Groundwater Source

2.7.3 Water Take for Consumptive Use

As part of the Basin Plan, Basin-wide limits have been set on the amount of groundwater that can be taken from the Basin. These limits are called sustainable diversion limits (SDLs). The SDLs are managed as part of the WRPs.

SDLs are determined by the NSW WSP available water determinations (AWD) process. An AWD is an NSW ministerial order issued to allocate water to the accounts of licence holders. AWDs are made on 1 July each year (beginning of the water year) and as necessary then throughout the year.

2.7.4 Existing Local Water Sources

It is understood that there is no water access licence (WAL) associated with the Project Area. Further to this, no existing harvestable rights dams exist within the Project Site.

Project water sourcing options are further discussed in Section 3.1.2.

2.7.5 Coleambally Irrigation Co-Operative Limited

CICL is Australia's fourth largest irrigation entity, holding water access licences (WALs) for ground and surface water throughout the Murrumbidgee Valley. Water supply is provided via the Murrumbidgee River with access to water based on the Murrumbidgee Regulated River Water Sharing Plan (2016). CICL also holds a groundwater access licence that is used to augment the CICL conveyance licensed water. The current area of operations of CICL is shown in Figure 2.6, with the Project located within the West Coleambally Water Management Area, which is comprised of landholdings that have access to the supply network from the Coleambally Outfall Drain.

CICL holds WALs for access to surface water and groundwater and is a significant holder of WALs in the Murrumbidgee Valley water sources.

CICL's water entitlements match its general security and high security water access licence volume and its history of use entitlements match its supplementary water licence volume. The water entitlements are categorised into the following classes:

- Class A water entitlements - high security.
- Class B water entitlements - general security.
- Class F water entitlements – opportunistic flow (distributed in proportion to delivery entitlements held by members).
- Class G water entitlements - domestic and stock.

It is assumed that the Project does not hold any CICL entitlements.

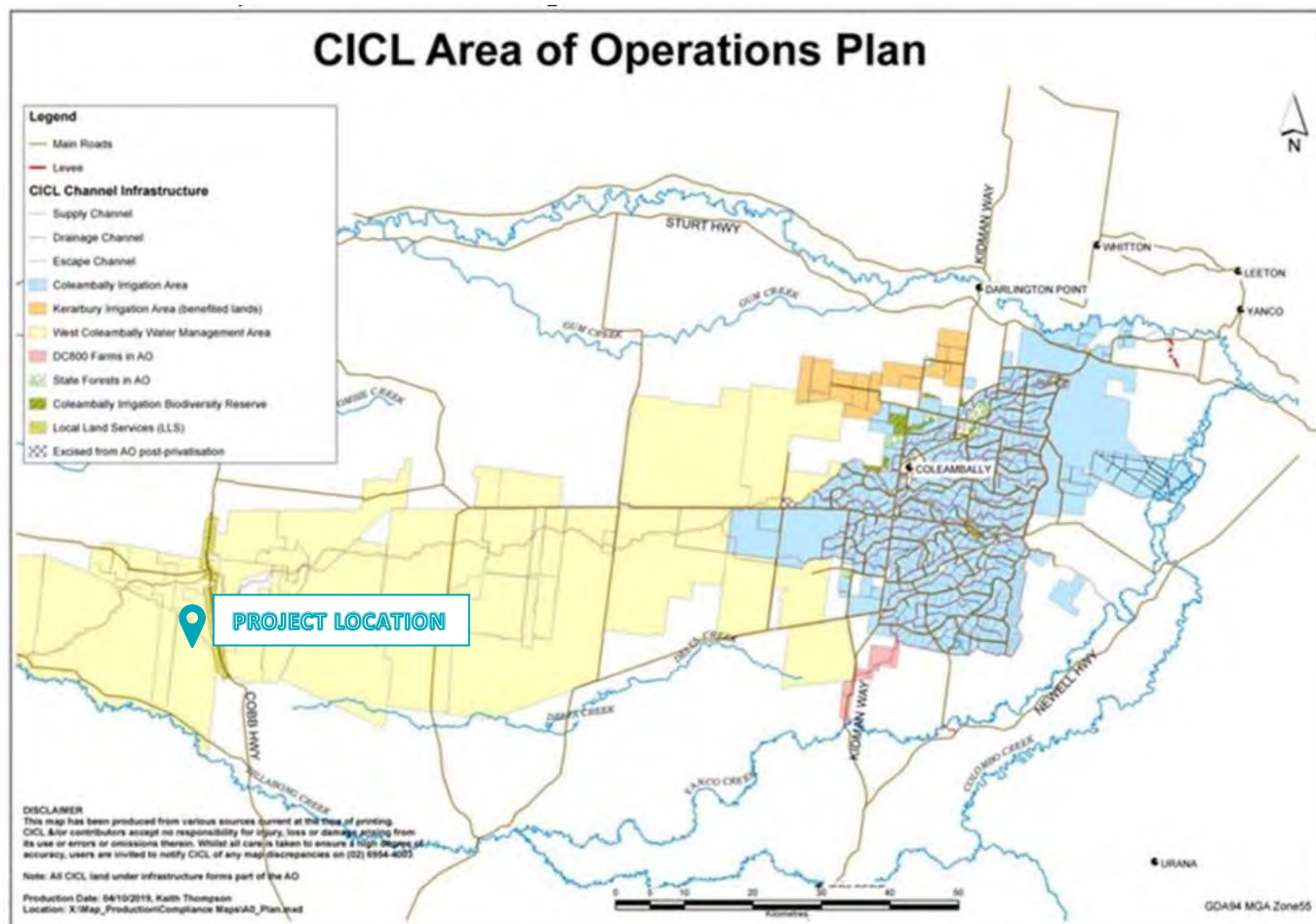


FIGURE 2.6: CICL AREA OF OPERATIONS (CICL ANNUAL COMPLIANCE REPORT 2023)

2.7.6 NSW Water Licensing and Approvals

The NSW Government controls the use and flow of all water in rivers, lakes, and aquifers. Some landholders can take water without a licence, this is known as basic land holder rights (refer to Section 2.7.6.1). You may need a water access licence or a water supply work and/or water use approval to take water from a river, lake or aquifer (refer to Section 2.7.6.2). Approvals can also be required for flood works that are likely to have an effect on the flow of water (refer to Section 2.7.6.3), and works within waterfront land (refer to Section 2.7.6.4).

The *Water Management Act 2000* applies to all regions where there is a WSP in operation.

The following sections discuss:

- Basic landholder rights, including the maximum harvestable right for the Applicant and associated land holdings.
- Water Access Licences, Water Use Approvals, and Water Supply Works, including those currently held by the Applicant and associated land holdings.
- Requirements for Flood Works and Controlled Activity Approvals, including what applies to the Project.

Future assessment would include:

- Calculation of Water take licensing requirements for the Project.
- Summary of Water use and Water supply works approvals required for the Project.

2.7.6.1 Basic Landholder Rights

There are three types of basic landholder rights (BLR) in NSW (*Water Management Act 2000*):

- Domestic and stock rights – allows take and use of water for domestic consumption and non-intensive stock watering without the need for a water access licence (WAL) or water use approval. A water supply work approval (i.e. for a bore or dam, etc) is required.
- Harvestable rights – allows landholders to capture and store a proportion of the rainfall runoff from their landholding in one or more harvestable rights dams, without requiring a WAL, water use approval or water supply work approval.
- Native title rights- allows take and use of water in the exercise of native title rights (under the *Commonwealth Native Title Act 1993*), without requiring a WAL, water use approval or water supply work approval (unless the work is a dam or bore).

2.7.6.1.1 Harvestable Rights

Harvestable Rights provisions for the capture and reuse of surface water runoff generated within a property, is subject to the following rules:

- (1) Landholdings (owned and leased) must be contiguous (generally omits public roads and easements).
- (2) Harvestable rights cannot be transferred between water sources – i.e. water captured within a water source must be covered by a harvestable right (or licence) in that source.
- (3) Water captured (in dams, mining pits, etc) from higher order (3rd order and above) watercourses and above or within 40 m (measured perpendicular), or on any floodplain, or on or within 3 km upstream of any Ramsar wetland, must be covered by a WAL, regardless of the Harvestable Right, unless exempt from licensing.

Harvestable rights dams do not require a WAL, water use approval or water supply work approval. However, if a harvestable rights dam also stores and/or captures water taken under another right or licence this dam is known as a Mixed-rights dam. Mixed-rights dams may require a WAL and water supply work approval prior to construction.

2.7.6.1.2 Maximum Capacity of Harvestable Rights Dams – Method of Calculation

WaterNSW provides a tool to estimate harvestable rights, based on location and property area ¹. This method uses a simple average annual unit runoff rate. The volume of water a landholder can capture and store under harvestable rights is expressed as a maximum harvestable right dam capacity for a landholding. The combined volume of all dams (or parts thereof) that capture and store harvestable rights water cannot exceed the maximum dam capacity.

There are three different harvestable rights orders applying to three different regions in NSW. These are:

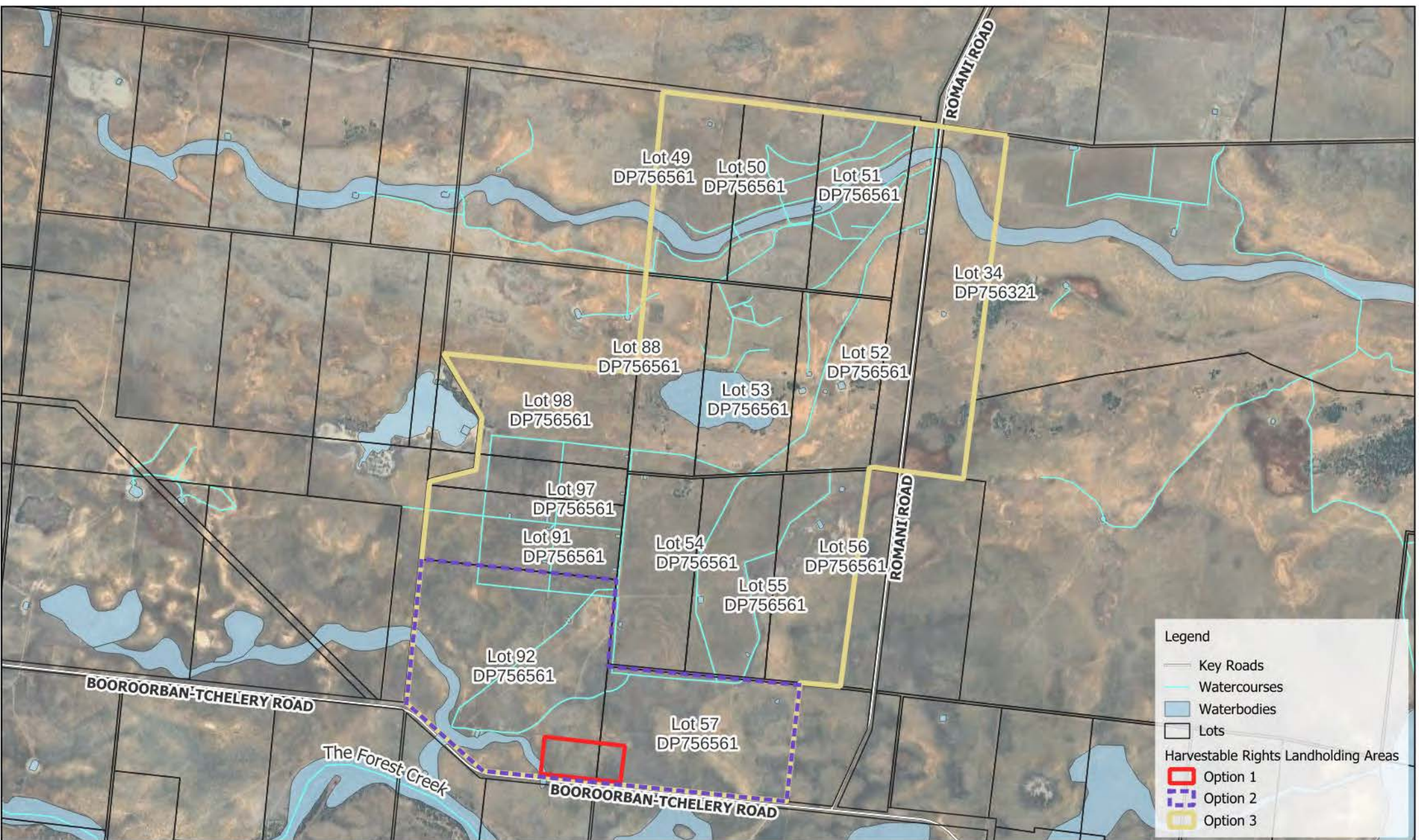
- Coastal-draining catchments
- Central inland-draining catchments
- Western division order.

The Project partially covers two lots within the Central inland-draining catchments, however, it is understood the Applicant has the option to lease a number of lots surrounding the Project Site for water harvesting. The method outlined below (refer to Section 2.7.6.1.3), was therefore undertaken for the following three scenarios:

- Option 1 - Project Site only.
- Option 2 - Full lots associated with Project Site, assuming the Applicant would have agreement with the landowners.
- Option 3 - Maximum landholdings available for lease, assuming the Applicant would have agreement with the landowners.

An overview of each of Option is shown no Figure 2.7, with outcomes summarised in Table 2.8.

¹ www.watarnsw.com.au/customer-service/water-licensing/blr/harvestable-rights-dams/maximum-harvestable-right-calculator



Legend

Key Roads

Watercourses

Waterbodies

Lots

Harvestable Rights Landholding Areas

Option 1

Option 2

Option 3

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NOTES:

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Figure 2.7: Landholdings for Harvestable Rights Options

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TABLE 2.8: MAXIMUM CAPACITY OF HARVESTABLE RIGHTS DAMS

Option	Contiguous Landholdings (ha)	Maximum Capacity of Harvestable Rights Dams (ML)
Option 1	20.09	0.9
Option 2	404.91	18.22
Option 3	1,809.81	81.44

2.7.6.1.3 Central-inland draining catchments

To calculate the maximum capacity of harvestable rights on a landholding the method outlined in Schedule 1 of the Harvestable Rights (central inland-draining catchments) Order 2022 dated 12 May 2022 should be used. This method is summarised, as follows:

- (1) Identify the location and total size of the landholding in hectares (being only that part within the harvestable rights area).
- (2) Identify the area (in hectares) of the landholding from which water is captured, taken or otherwise impounded by means of an excluded work or works specified in clauses 1-4 in Schedule 1 to the Water Management (General) Regulation 2018.
- (3) Calculate the capacity for a harvestable rights dam or dams which represents up to 10% of the average annual regional rainfall runoff on the landholding – multiply (1) by the harvestable rights multiplier (Type 1).

2.7.6.2 Water Access Licences, Water Use Approvals, and Water Supply Works

2.7.6.2.1 Water Access License (WALs)

In water sharing plan (WSP) areas, a WAL authorises the holder of the WAL to take water from a water source.

There are a number of exemptions for WALs specified in the *Water Management (General) Regulation 2018*. Exemption categories include landholders, public authorities, and general exemptions.

There are three types of WALs:

- Zero share licence.
- Specific purpose access licence.
- Controlled allocation licence.

The Applicant currently hold no WALs.

A summary of the WALs issued for the water source in which the Project lies is included in Table 2.9.

TABLE 2.9: MURRUMBIDGEE WESTERN WATER SOURCE – TOTAL WALs 2024/2025

Access Licence Category	No. of WAL(s)	Total Share Component	Total IDEC (Daily flow shares)	Cumulative AWD
Domestic and stock	10	70	N/A	1
Domestic and stock [stock]	4	20	N/A	1
Unregulated river	11	14,870	N/A	1

TABLE 2.10: MURRUMBIDGEE REGULATED RIVER WATER SOURCE – TOTAL WALs 2024/2025

Access Licence Category	No. of WAL(s)	Total Share Component	Total IDEC (Daily flow shares)	Cumulative AWD
Coleambally Irrigation (Conveyance)	3	130,000	N/A	2
Domestic and stock	301	19,094.24	N/A	1
Domestic and stock [domestic]	50	273.25	N/A	1
Domestic and stock [stock]	164	10,626.3	N/A	1
Local Water Utility	14	23,816	N/A	1
Murrumbidgee Irrigation (Conveyance)	3	243,000	N/A	3
Regulated River (Conveyance)	3	2,968	N/A	3
Regulated River (General Security)	890	1,892,004.7	N/A	3
Regulated River (High Security)	224	364,425.91	N/A	1
Regulated River (High Security) [Aboriginal Cultural]	1	2,150	N/A	1
Regulated River (High Security) [Lake Albert Filling]	1	1,800	N/A	1
Regulated River (High Security) [Research]	1	300	N/A	1
Regulated River (High Security) [Town Water Supply]	2	19,769	N/A	1
Supplementary Water	239	198,779.8	N/A	1
Supplementary Water (Lowbidgee)	26	747,000	N/A	1

2.7.6.2.2 Water Supply Work and/or Use Approvals

Water supply work and/or water use approvals allow you to use water from a river, lake, or groundwater source, and to construct infrastructure to do this.

A water supply work approval allows construction and use of works to take water (e.g. pumps, bores, dams, dewatering, etc).

A water supply use approval allows use of water for a particular purpose (e.g. irrigation, power generation, mining, etc).

A water use approval allows you to use water on your land. Examples of water uses that require approval are irrigation, town water supply, power generation and mining.

A summary of all water supply work and use approvals applicable to the Project Site is included in Table 2.11. There are no WALs associated with the Project Site.

TABLE 2.11: WATER SUPPLY WORK AND USE APPROVALS APPLICABLE TO THE PROJECT SITE

Kind of Approval	Purpose / Work Type	Approval Number	Lot / DP
Water Use	Irrigation	40UA403184	Lot 57 and 92 DP 756561

2.7.6.3 Flood Works Approval

Flood work approvals allow you to construct and use a work that is situated in or near a river, estuary or lake, or within a floodplain, and is likely to have an effect on the flow of water to or from a river, estuary or lake, or the distribution or flow of floodwater.

Major projects which are SSD or state significant infrastructure are exempt from flood work approvals.

2.7.6.4 Controlled Activity Approval

Controlled activities refer to work or action done on waterfront land, as defined by the *Water Management Act 2000*. These activities must be designed in a way to protect our waterways and ensure minimal harm as a result of the work carried out on the land, and include:

- Waterfront land includes the bed of rivers, lakes, or estuaries, as well as land on each side within 40 metres of a riverbank.
- That is within 40 m of the high bank of all watercourses with defined bed and banks as well as $\geq 3^{\text{rd}}$ order DCCEEW mapped hydrolines.

Controlled activities may include:

- Erecting a building.
- Carrying out works: including the construction of bridges, roads, control measures, sea walls, and more.
- Removing material from waterfront land: including plants, rocks, sand, gravel and more.
- Depositing material on waterfront land: including gravel or fill.
- Any activity which affects the quantity or flow of water in a water source.

Although SSD projects are exempt from requiring Controlled Activity Approvals, where the Project involves a controlled activity, assessment and design would be in accordance with:

- *DPI Guidelines for Controlled Activities on Waterfront Land (2018)*.
- *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003)*.
- *Policy & Guidelines for Fish Habitat Conservation & Management (DPI, 2013)*.

3. PROPOSED WATER MANAGEMENT

3.1 Water Balance

Water supply would be required during the Project construction phase, including for:

- Dust suppression.
- Construction of infrastructure hardstand areas.
- Road construction and compaction.
- Vehicle equipment washdown.
- Potable water for site amenities.

3.1.1 Water Demands

Water demand would vary, depending on the stages of construction. The total water demand during construction, presented in Table 3.1, has been estimated based on the current Project layout, as described in Section 1.3. Post-construction water demands would be negligible, primarily consisting of potable water demands. A detailed breakdown of the assumption adopted in the water demand estimation is included in Appendix E.

TABLE 3.1: SITE WATER DEMANDS SUMMARY

Demand	Total Demand (ML)
Construction of hardstands	0.3
Road construction / compaction	1.0
Dust suppression	0.4
Vehicle and equipment washdown	4.7
Potable water	1.9 – 2.3 ¹
Total Construction Demand	8.3 – 8.7¹

¹ Range based on average and peak workforce for the full construction period.

The construction water demands are based on the workforce breakdown available at the time of this assessment, which includes a peak workforce of up to approximately 100 full time employees during installation of the BESS. During operation, it is assumed that approximately 3-5 full time employees would be required.

The peak raw (non-potable) demand is expected to occur during site set up, due to road construction and compaction. The peak potable water demand is expected to occur during installation of the BESS when workforce is at 100 FTE. This results in the following maximum demand rates:

- Maximum daily non-potable construction demand = 13.8 kL/day.
- Maximum daily potable construction demand = 5.0 kL/d.
- Maximum daily operational demand = 0.3 kL/d (potable water for employees only).

The provided water demand volumes and rates are estimates based on the information available at the time of this assessment and would be confirmed during detailed design.

3.1.2 Water Supply

The Applicant does not own any of the land within the Project Site, and therefore would be limited in their water harvesting options. To fulfill non-potable construction and operation water demands, this would be sourced by purchasing and transporting water to site by water cart.

Discussions with Edward River Council, neighbouring Councils (e.g. Hay Shire Council) and other local private water supply companies indicate that potable and non-potable water requirements for the Project can be met through available supplies from these sources. The Applicant would transport this water to the Project site as required, in consultation with the relevant council to ensure no disruption to residential supply.

Although not anticipated to be required, alternate non-potable water sourcing options include:

- Reuse water from sediment basins (which may be used during the construction phase to prevent contamination of downstream watercourses). It is important to note that the ability to make use of this water supply would be dependent on available infrastructure (dams) and rainfall.
- Land Agreements to access water via WALs held by the landholder. The Applicant may enter agreements with landholders that hold existing water access licences (WALs) to source surface or groundwater using the WAL. The following would need to be considered:
 - The type of WAL held by the landholder (e.g., WALs for stock and domestic purposes would not be able to be used).
 - The WAL entitlement (i.e. how much water can be accessed under the WAL).
 - Water security considerations associated with the different types of WALs (e.g., the availability of groundwater would be more consistent than surface water during periods of low rainfall).
- Purchasing WALs and entering landholder agreements to register the associated Work Approvals. If there are WALs available in the water sources relevant to the Project Site, the Applicant could seek to purchase these WALs. The WALs would need to be associated with works approvals for the structures used to capture and/or extract the water (e.g. dams, weirs, bores, pumps etc.). The Applicant would enter into agreements with landholders to register these works approvals to the relevant lot owned by the landholder. A summary of total WALs currently issued under each relevant surface water source is provided in Section 2.7.6.2.
- Recycling and reuse of water.

Separate dedicated firewater tanks will be filled by rainwater, with any additional water, if required, purchased and imported to the site.

Where possible during construction, water should be recycled and reused. It is assumed that this would likely be possible for vehicle and equipment washdown demands.

It is understood that no extraction of groundwater is proposed, however, if deemed necessary to support construction, the Applicant would obtain applicable WALs, works approvals and water use approvals prior to any water extraction taking place. The requirement for such activities would be determined during the detailed design stage of the Project.

3.1.3 Wastewater Management

During construction, wastewater from the site office and temporary construction facilities would be collected and managed through an on-site treatment system. The treated wastewater would be re-purposed on site to fulfill non-potable construction and operation demands such as dust suppression, earthworks and concrete conditioning. To prevent interaction with natural surface and groundwater systems, the treated wastewater would be contained in tanks on site.

Waste solids generated by the treatment system would be handled by a licensed contractor to transport and dispose of at a nearby Council wastewater treatment plant or other appropriately licensed facility.

The specifics of the on-site wastewater management system, including its design and capacity, would be determined in the detailed design phase, and should consider best practice guidelines and standards.

Once construction is complete, all temporary wastewater management infrastructure would be decommissioned and removed from the Project Site for rehabilitation.

4. FLOOD MODELLING

4.1 Assessment Methodology

The following sections summarise the methodology used for the flooding modelling of the Project Site and surrounds. Further detail is provided in the Basis of Modelling report in Appendix A.

4.1.1 Study Area and Assessment Approach

The Project Site is located to the north of The Forest Creek. However, despite these defined watercourses, an initial review of the catchment upstream of the Project area determined that the watercourses are extremely poorly defined, with an average slope of 0.04%, an approximate flow distance of 165 km and total local catchment area of around 6,300 km². The lack of topographic definition makes delineating catchments accurately enough to allow for hydrological modelling unfeasible.

To remedy this, a two staged hydraulic model approach was undertaken, with two separate models being built to support these stages:

- Regional Catchment Study Area – this model undertook a catchment wide rain-on-grid (RoG) approach to modelling the entire upstream reporting catchment for the Project Site, to provide hydrograph inflows to a smaller scale site model.
- Local Project Site – this model simulated the Project Site separately to the regional catchment, applying a local RoG inflow, whilst also utilising the hydrographs extracted from the downstream boundary of the Regional Catchment Hydraulic Model to represent the wider catchment contribution.

In tandem to this assessment, a third hydraulic model was also undertaken to understand the relationship between the Murrumbidgee River at the local catchments relative to the Project Site. This was undertaken using supporting information from the existing BMT *Murrumbidgee River at Darlington Point and Environs Flood Study*, dated December 2018 (ref. R.N20795.001.05). The key takeaway from this assessment was the lack of relationship between the flooding of the Murrumbidgee River and the Project Site, due to both the low chance of a coincident event occurring, and the containment of flow to the Murrumbidgee River in the extreme events.

This is further reinforced by other studies undertaken within the Murrumbidgee River floodplain. Section 2.3.2 identifies a study undertaken by Lyall & Associates which investigated both a regional Murrumbidgee River flood event and a local catchment flood event without any flow from the river. This assessment determined worst case flooding conditions were due to the local catchment.

No assessment has been undertaken for a coincident scenario, due to the high improbability of such an event.

4.1.2 Key Assumptions

This assessment uses the following assumptions regarding the Project Site:

- Permanent ancillary infrastructure (BESS/substation/switching station) is located above all assessed events.

4.2 Model Development

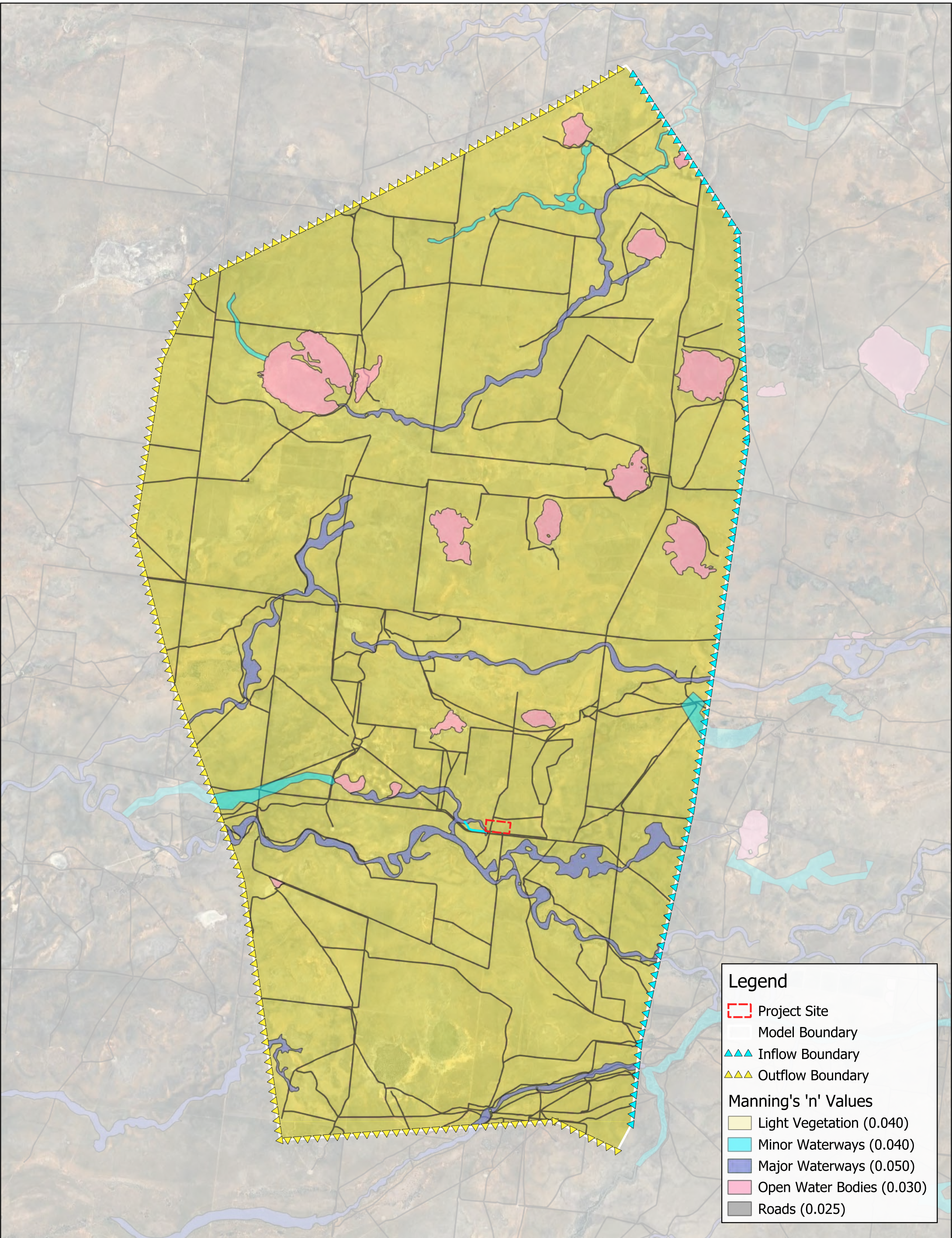
The 2D hydraulic model was developed using the TUFLOW modelling package. Key aspects of the hydraulic model development are summarised in Table 4.1. A description of the model layout is provided below, and an overview of the Local Project Site model is shown in Figure 4.1. The Regional Catchment Study model's layout is included in the Basis of Modelling report in Appendix A.

TABLE 4.1: HYDRAULIC MODEL DEVELOPMENT AND PARAMETERS

Model Parameter	Details
Grid Size	Regional Catchment Study Area - cell size of 60 m, with a 10 m sub-grid sampling (SGS) size. Local Project Site – cell size of 20 m, with a 5 m sub-grid sampling (SGS) size.
DEM	Compiled from the following sources: 1 m and 5 m NSW LPI LiDAR (flown between 2011 - 2022).
Timestep and Model Build	The hydraulic models use TUFLOW's Heavily Parallelised Compute (HPC) computational method for calculations of the Shallow Water Equation. A part of this allows for the model to use a variable time step. The model build used for each assessment was 2023-03-AB.
Assessed Events	The 5% AEP and 1% AEP events were assessed. The Probable Maximum Flood (PMF) was not assessed using the standard ARR approach, due to limitations in available data. Instead, the "Extreme" flood terminology was adopted, which used multiplied the 1% AEP event by three times. This is in line with other assessments within the region, such as BMT's Murrumbidgee River assessment (BMT, 2018). For the current baseline assessment, two climate change events were assessed, those being the 0.5% AEP and 0.2% AEP.
Assessed Durations and Temporal Patterns	For each of the five events to be assessed, durations ranging from the 72 hr to the 168 hr were assessed to determine the critical event for the Regional Assessment. This was done by assessing the front, mid and back load temporal patterns for each event. The critical events that were identified for the Regional Assessment were then applied to the Local Project Site Assessment. The 0.5% and 0.2% AEP events both utilised the same durations and temporal patterns as the 1% AEP event.
Downstream Boundary	Represented as a normal depth based on low flow channel grades at the downstream extent of the models. For the Regional Study, this is approximately 15 km downstream of the upstream end of the Project Site. For the Local Study, this is approximately 5 km downstream of the Project Site. Downstream boundaries were applied to the TUFLOW model to allow flow to exit the model area.
Inflow Boundaries	Regional Catchment Study Area – no discrete inflow boundaries have been applied, with flow applied directly across the model terrain using the RoG method. Local Project Site – two inflow types have been used, cumulative inflow hydrographs, extracted from the Regional Catchment Study Area, were applied along the upstream boundary of the model; and local catchment flows within the Local Project Site domain were spatially distributed using the RoG method.
Aerial Photography	Aerial imagery was sourced from ArcGIS online Esri Imagery and Google Maps.
Manning's 'n' Roughness	Refer to Table 4.2.

TABLE 4.2: MANNING'S VALUES

Land Use Type	Manning's 'n' Value
Open Water Bodies	0.030
Minor Waterways	0.040
Major Waterways	0.050
Light Vegetation	0.040
Dense Vegetation	0.075
Crops	0.060
Roads (and other hardstand areas, e.g. infrastructure)	0.025
Site Infrastructure	0.045



Legend

- Project Site
- Model Boundary
- Inflow Boundary
- Outflow Boundary
- Manning's 'n' Values**
 - Light Vegetation (0.040)
 - Minor Waterways (0.040)
 - Major Waterways (0.050)
 - Open Water Bodies (0.030)
 - Roads (0.025)

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0 1 2 3 km



Scale in metres (1:90,000 @ A3)

Map Projection: Transverse Mercator
Horizontal Datum: Australia Geodetic Datum
Vertical Datum: Australia Geodetic Datum
Grid: Australian Map Grid, Zone 56

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Figure 4.1: Local Project Site TUFLOW Model

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4.3 Existing Flood Behaviour

Appendix B contains mapping of flood depth, height, velocity, and hazard categories for the baseline flooding results (i.e. with the Project Site undeveloped) for the 5%, 1% AEP and PMF events. The following is a summary of the baseline results within the Project Site.

- Flooding within the Project Site is dominated by ponding from downstream flow paths due to the flat topography of the area. The eastern edge of the Project Site is located on the downstream end of a minor overland flow path that drains to The Forest Creek to the south. The Project is located on the floodplain of The Forest Creek, and therefore when The Forest Creek floods, this impacts the Project Site. This is observed in all simulated events.
- Flood depths typically do not exceed 0.5 m across the Project Site in events up to the 1% AEP. In the PMF event, flood depths max out at 1.2m in the southern part of the Project Site due to the tailwater impacts from The Forest Creek.
- Flood velocity through the Project Site generally remains below 0.5 m/s in all events. The highest velocities are recorded at the south-eastern corner of the Project Site within the main overland flow path, peaking at approximately 0.41 m/s in the PMF.

4.3.1 Flood Hazard Classification

The general flood hazard curves and categorisation presented in ARR (Ball, et al., 2019) have been adopted (refer to Figure 4.2) to determine the flood hazard categorisation for the project Area. In accordance with the methodology in the *Australian Disaster Resilience Handbook 7 – Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (AIDR, 2017), the combined flood hazard curves set hazard thresholds that relate to the vulnerability of the community when interacting with floodwaters. The combined curves are divided into hazard classifications that relate to specific vulnerability thresholds as described in Table 4.3.

From the flood hazard mapping in Appendix B, the predominant hazard category for the site is H1 (generally safe for people, vehicles and buildings) in the 5% and 1% AEP events. In the PMF event however, a peak value hazard of H3 (unsafe for vehicles, children and the elderly) is observed.

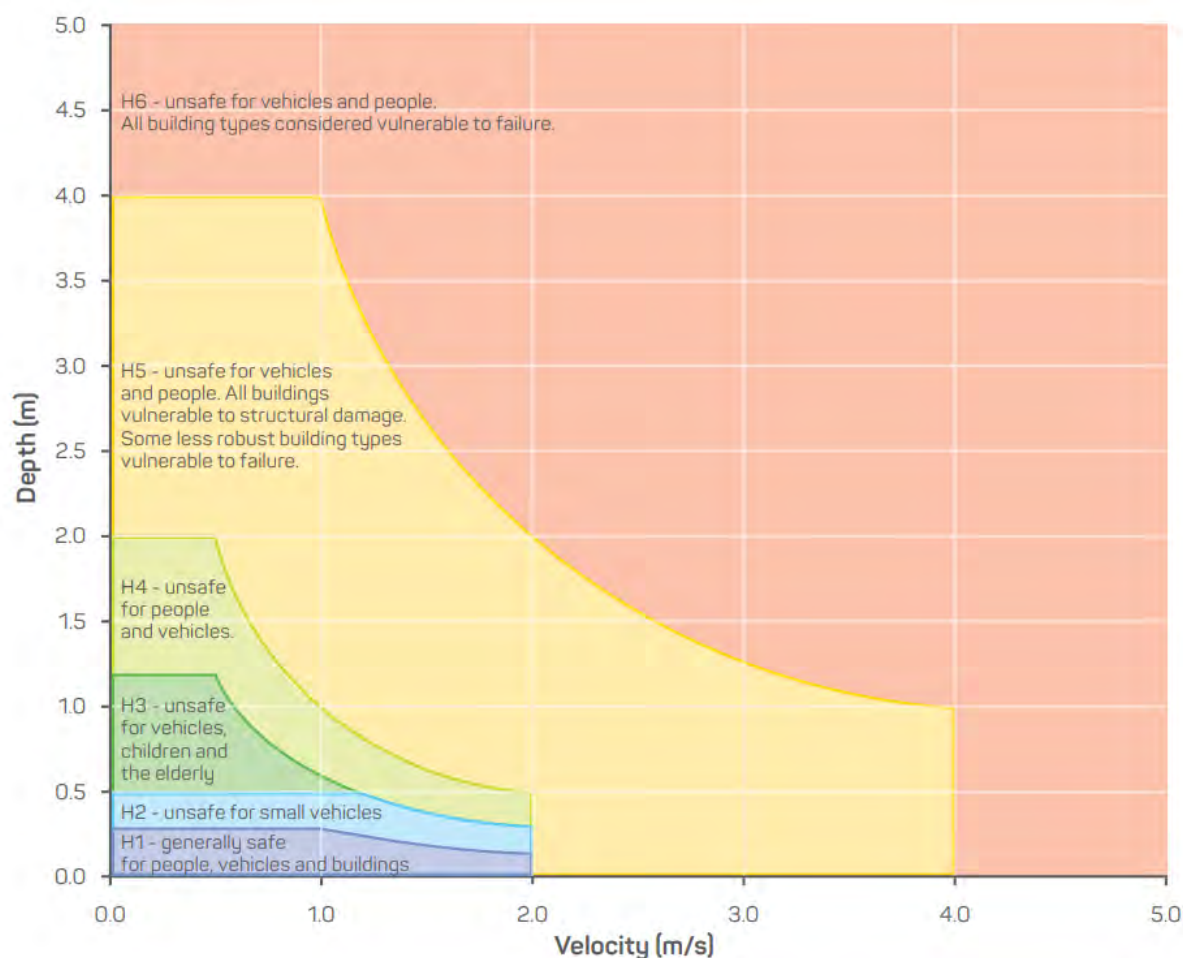


FIGURE 4.2: FLOOD HAZARD CATEGORIES

TABLE 4.3: COMBINED HAZARD CATEGORIES – VULNERABILITY THRESHOLDS AND LIMITS

Hazard Vulnerability Classification	Description	Classification Limit (D and V in combination) m ² /s	Limiting still water depth (D) m	Limiting velocity (V) m/s
H1	Generally safe for vehicles, people and buildings.	$D*V \leq 0.3$	0.3	2.0
H2	Unsafe for small vehicles.	$D*V \leq 0.6$	0.5	2.0
H3	Unsafe for vehicles, children and the elderly.	$D*V \leq 0.6$	1.2	2.0
H4	Unsafe for vehicles and people.	$D*V \leq 1.0$	2.0	2.0
H5	Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure.	$D*V \leq 4.0$	4.0	4.0
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.	$D*V \leq 4.0$	-	-

4.3.2 Flood Planning Area

The flood planning area for the Project Site has been considered by assessing the 1% AEP and adding 0.5 m freeboard to the flood levels, in accordance with the recommended methodology in the *Flood risk management manual* (DPE, 2023). Due to the assessment using a RoG approach, depths less than 10 mm have not been included in the 1% AEP flood extent. The flood planning area extent within the Project Site is provided in Figure 4.3, which results in the entire Project Site being classified as Flood Planning Area.

4.3.3 Hydraulic Categorisation

Three hydraulic categories of flood prone land are identified, those being the floodway, flood storage and flood fringe, and are a distinction used to aid in the process of developing a floodplain risk management plan. The DEP *Floodplain Risk Management Guideline* document definitions and the adopted criteria for each categorisation are summarised in Table 4.4. Figure 4.4 provides the hydraulic categorisation within the Project Site for each of these areas.

TABLE 4.4:HYDRAULIC CATEGORISATION

Category	Definition	Adopted Criteria
Floodway	Are generally areas which convey a significant portion of water during floods and are particularly sensitive to changes that impact flow conveyance. They often align with naturally defined channels.	Hazard Category of ≥ 4
Flood Storage	Are areas outside of a floodway and are generally areas that store a significant proportion of the volume of water and where flood behaviour is sensitive to changes that impact water storage during a flood.	Hazard Category of < 4
Flood Fringe	Are areas within the extent of flooding for the event but which are outside floodways and flood storage areas. Flood fringe areas are not sensitive to changes in either flow conveyance or storage.	PMF extent



Legend

-  Project Site
-  Flood Planning Area

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0 100 200 m

Scale in metres (1:5,000 @ A3)

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure 4.3: Flood Planning Area

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Legend

- Project Site
- Hydraulic Categorisation
 - Floodway
 - Flood Storage
 - Flood Fringe

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0 100 200 m

Scale in metres (1:5,000 @ A3)

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
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Figure 4.4: Hydraulic Categorisation

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4.3.4 Climate Change Sensitivity Assessment

A climate change sensitivity assessment was undertaken to understand the sensitivity of flooding and flood impacts to climate change. The 0.5% and 0.2% AEP design events are typically used as proxies for climate change and have been adopted as so for this assessment. A comparison of the flood extents between these events and the 1% AEP event is presented in Figure 4.5. This assessment shows that the change in flood extents is negligible.

4.4 Developed Flood Behaviour

Appendix C contains mapping of flood depth, height, velocity, and hazard categories for the following flood modelling results for the ultimate flooding results (i.e. with the Project Site developed) for the 5%, 1% AEP and PMF events. Appendix D provides the flood height and velocity afflux result for the 5%, 1% AEP and PMF events.

The changes made to the baseline hydraulic model to represent the development of the Project Site are as follows:

- Change to Mannings 'n' value for BESS infrastructure to be in accordance with Table 4.2.
- BESS infrastructure modelled above the PMF flood level.

The following is a summary of the developed results within the Project Site:

- The BESS infrastructure requires a pad level of 81.2 mAHD to be flood immune (81.7 mAHD to achieve 500 mm freeboard) in the 1% AEP event. Due to the RoG approach, they still show some flood flows on the figures in Appendix C. The inundation shown on the figures is related to local runoff.
- Local impacts up to 50 mm are reported in both the 1% AEP and PMF events. These impacts extend outside of the Project Site. The 5% AEP event reports negligible impacts around the Project Site.
- Some decreases in flood depth are observed west of the Project Site in the 1% AEP and PMF events, on the downstream side of the infrastructure. In some instances.
- Negligible changes in flood velocity impacts (± 0.5 m/s) are reported through the Project Site in all flood events.
- Flood hazard remains between at H1 for the 5% and 1% AEP. The PMF event continues to report H3.

The impacts and associated with flooding, both on the Project and from the Project are further discussed in Section 5.



Legend

Project Site

Climate Change Sensitivity Assessment

1% AEP Flood Extent

0.5% AEP Flood Extent

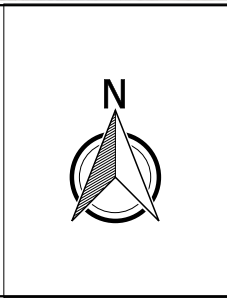
0.2% AEP Flood Extent

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0100200 m

Scale in metres (1:5,000 @ A3)

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Vertical Datum: Australia Height Datum
Grid: Map Grid of Australia, Zone 56

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Figure 4.5: Climate Change Sensitivity Assessment

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5. SURFACE WATER IMPACT ASSESSMENT

The following sections detail the potential impacts to surface waters associated with the Project during the construction, operation and decommissioning phases, including to:

- Flow Regimes.
- Waterfront Lands.
- Flooding.
- Water Quality.
- Erosion and Sedimentation.

5.1 Watercourse Characteristics

5.1.1 Flow Regimes

The proposed work is not proposed to involve modification or realignment of any natural watercourses traversing the Project Site, resulting in no impacts to flowpaths or stream ordering. The proposed disturbance associated with construction and operation infrastructure (e.g. BESS, ancillary infrastructure and roads) may result in disturbance of minor overland flow paths. Where possible, the proposed roads in addition to existing access tracks would be used during construction and operation of the Project, limiting additional crossings of flow/drainage paths.

There is one natural waterbody that crosses the south-western corner of the Project Site and extends approximately 5 km westward, sloping away from the Project towards a perennial swamp. This waterbody receives inflows from a local catchment as well as overflows from The Forest Creek during larger flood events. No Project infrastructure is proposed within the waterbody (refer to Figure 2.3), reducing the potential for the Project to impact overland flow regimes in larger flow events.

5.1.2 Waterfront Land

As described in Section 5.1.1, installation of the BESS and associated infrastructure are not proposed within the natural waterbody located within the Project Site. The waterbody is defined by the DCCEEW published mapping dataset (2018) as a natural watercourse that is mainly dry. In accordance with the definition in Section 2.7.6.3, the DPE *Guidelines for instream works on waterfront land* (DPE, 2022) and *Guidelines for riparian corridors on waterfront land* (DPE, 2022) should be considered, however, it is considered a minor water feature and further design in accordance with *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge, 2003) and the *Policy & Guidelines for Fish Habitat Conservation & Management* (DPI, 2013) is not required.

Mapped waterfront land for the waterbody is shown on Figure 2.3. The proposed works (BESS installation) are considered unlikely to significantly modify the flow within the watercourse, or any existing riparian vegetation.

5.1.3 Flooding

During construction, operation and decommissioning of the Project, careful consideration should be given to the impacts of flooding both on the Project itself and any potential changes to flooding downstream of the Project.

The flood assessment has considered the impacts of both temporary and permanent infrastructure. Due to flows in the Project Site being dominated by overland sheet flow, most of the proposed infrastructure is located within the Baseline (existing), 5% AEP, 1% AEP and PMF flood extents. A summary of peak flood depths and velocities recorded adjacent to each infrastructure item is included in Table 5.1.

The peak velocities observed across the Project Site are minor and do not present significant risk of erosion.

TABLE 5.1: PEAK FLOOD DEPTH AND VELOCITY ADJACENT TO PROJECT INFRASTRUCTURE

Infrastructure Item	Peak Flood Depth (m)			Peak Flood Velocity (m/s)		
	5% AEP	1% AEP	PMF	5% AEP	1% AEP	PMF
BESS Area	0.18	0.43	1.21	0.13	0.21	0.41

The flood assessment (refer to Section 4) indicates that the Project has potential to impact surrounding properties in the 1% AEP and PMF events. It is noted that these impacts are limited to adjacent farmland and no residential dwellings or buildings are affected.

5.2 Water Quality

Several components of the Project introduce potential for impacts to the quality of surrounding surface water. The activities and potential impacts are summarised in Table 5.2 and discussed in further detail in subsequent sections. Potential mitigation measures are discussed in further detail in Section 7.

TABLE 5.2: SURFACE WATER QUALITY IMPACTS

Project Phase	Project Component	Activity	Risk / Impact	Mitigation Measure Overview
Construction	- Establishment of temporary laydown, storage and site facilities areas. - Construction of permanent ancillary infrastructure (BESS and Substations)	- Vegetation clearing and ground disturbance. - Earthworks. - Concrete works. - Vehicle movement. - Soil stockpiling.	- Soil erosion and sedimentation of downstream watercourses and crops. - Spill of hydrocarbons or other pollutants used to support transportation and construction activities. - Release of stockpiled materials or concrete by-products (dust, slurry, water) into downstream watercourses and crops.	- Erosion and Sediment Control Plan (ESCP). - Construction Environmental Management Plan (CEMP).
	Construction / establishment of access tracks.	- Vegetation clearing and ground disturbance. - Earthworks. - Vehicle movement.	- Soil erosion and sedimentation of downstream watercourses and crops. - Spill of hydrocarbons or other pollutants used to support transportation and construction activities.	- Erosion and Sediment Control Plan (ESCP). - Construction Environmental Management Plan (CEMP).
	Installation of electrical infrastructure (underground).	- Vegetation clearing and ground disturbance. - Earthworks. - Vehicle movement.	- Soil erosion and sedimentation of downstream watercourses and crops. - Spill of hydrocarbons or other pollutants used to support transportation and construction activities.	- Erosion and Sediment Control Plan (ESCP). - Construction Environmental Management Plan (CEMP).

Project Phase	Project Component	Activity	Risk / Impact	Mitigation Measure Overview
	Site workers.	Wastewater from site amenities.	Discharge / spill of wastewater (treated or untreated) into downstream watercourses and crops.	Appropriately designed and maintained wastewater management system.
Operation	Site workers.	Wastewater from site amenities.	Discharge / spill of wastewater (treated or untreated) into downstream watercourses and crops.	Appropriately designed and maintained wastewater management system.
	Use of access tracks.	Vehicle movement.	- Soil erosion and sedimentation of downstream watercourses and crops. - Spill of hydrocarbons or other pollutants used to support transportation and operation activities.	- Erosion and Sediment Control Plan (ESCP). - Construction Environmental Management Plan (CEMP).
Decommissioning	Removal of BESS and ancillary infrastructure.	- Ground disturbance. - Vehicle movement.	- Soil erosion and sedimentation of downstream watercourses and crops. - Spill of hydrocarbons or other pollutants used to support transportation and installation activities.	- Erosion and Sediment Control Plan (ESCP). - Construction Environmental Management Plan (CEMP).
	Rehabilitation establishment.	Planting and mulching.	Release of tannins to downstream watercourses and crops.	Erosion and Sediment Control Plan (ESCP).

There is one natural waterbody located through the edge of the Project Site, which is classified by the by DCCEEW as being mainly dry, with limited connectivity to downstream watercourses. With the mitigation measures tabulated in Table 5.2, it is considered that potential surface water quality impacts would be negligible.

5.2.1 Construction

During the Project construction phase, potential risks to surface water quality are higher due to greater amounts of ground disturbance and earthworks, vehicle movement, concrete works, and stockpiling, require management. As outlined in Table 5.2, the key risks include:

- Soil erosion and sedimentation of downstream watercourses and crops.
- Spill of hydrocarbons or other pollutants used to support transportation and installation activities.
- Release of concrete by-products (dust, slurry, water) into downstream watercourses and crops.
- Discharge/spill of wastewater (treated or untreated) into downstream watercourses and crops.

If sediments are exposed to the surrounding environment, they can degrade water quality, affect aquatic habitats, and harm crops through siltation. The impacts and mitigation strategies for the mobilisation and release of sediments during construction activities is further discussed in Section 5.3.

Surface water contamination resulting from a spill of hydrocarbons or other chemical pollutants, including concrete by-products, can be toxic to aquatic life, contaminate downstream watercourses and have long-term ecological impacts. Spills and contamination may also affect surrounding vegetation and soil, resulting in contamination of shallow groundwater pockets within and surrounding the Project Site,

potentially harming crops that rely on water from affected sources. Best practice spill management controls can adequately minimise the potential contamination impacts.

Similarly, the discharge or spill of wastewater, whether treated or untreated, into downstream watercourses presents a risk to surface water quality. Untreated wastewater may contain pollutants harmful to aquatic life, while even treated effluent and residual solids can also contain residual chemicals that can impact the environment. These impacts can be significantly reduced through design, location and implementation of a suitable wastewater management system.

If unmanaged, the overall effect of the above risks could cause detrimental impacts on the ecological balance of watercourses. However, considering the limited connectivity of the Project to adjacent watercourses and through adopting best practice approaches and proposed mitigation measures (Section 7), these impacts are considered negligible. Such mitigation measures include the development of an Erosion and Sediment Control plan (ESCP), suitable placement and controls for sediment stockpiles and hydrocarbon storage.

5.2.2 Operation

As outlined in Table 5.2, potential surface water quality impacts associated with the Project operation phase include:

- Soil erosion and sedimentation of downstream watercourses and crops, associated with vehicle movement, scouring and poor site stabilisation.
- Spill of hydrocarbons or other pollutants used to support transportation and operation of substations.
- Discharge / spill of wastewater (treated or untreated) into downstream watercourses and crops.

Operation activities, as well as poor site stabilisation following construction may result in sediments being exposed to the surrounding environment. As discussed in Section 5.2.1, this can degrade water quality, affect aquatic habitats, and harm crops through siltation. The impacts of the mobilisation and release of sediments during operation activities is further discussed in Section 5.3.

Surface water contamination resulting from a spill of hydrocarbons and wastewater would be managed through the same processes used during construction (refer to Section 7) and are considered negligible with these management measures in place.

5.2.3 Decommissioning

The equipment and process required for Project decommissioning would be similar to the construction phase and therefore result in similar risks to surface water quality due to ground disturbance, vehicle movement, and vegetation management. As outlined in Table 5.2, risks associated with decommissioning and rehabilitation are summarised below:

- Soil erosion and sedimentation of downstream watercourses and crops.
- Spill of hydrocarbons or other pollutants used to support transportation and decommissioning activities.
- Release of tannins to downstream watercourses and crops (considered a low risk in context of the vegetation types).

Water quality mitigation and management measures required during the construction phase would be informed by the practices used during construction and are further discussed in Section 7. With the proposed management measures in place, overall water quality impacts during decommissioning are expected to be negligible.

5.3 Erosion and Sedimentation

5.3.1 Construction

Project construction would require up to 13.2 ha of land disturbance for the construction of the BESS and establishment of site facilities and access tracks. Construction activities involving ground disturbance, earthworks and transporting and stockpiling soil introduce pathways for soils erosion and, in turn, potential movement of sedimentation into downstream water systems.

Impacts associated with the mobilisation of soil include:

- Degradation of the quality of downstream domestic and stock drinking water.

- Increased turbidity and reduced visual clarity of downstream watercourses, impacting aquatic ecosystem health (changes to natural reflectance of water, smothering aquatic life and clogging fish gills).
- Increased sediment build up in downstream watercourses and waterbodies, changing the geomorphology and disturbing natural flow regimes.
- Increased levels of dissolved metals and nutrients become mobilised with the soil, entering watercourses and waterbodies. This can be a threat if high concentrations of undesirable metals and nutrients reach water supplies for aquatic life or domestic, irrigation and livestock users.

Project construction would require area specific erosion and sediment control plans (ESCP) to be developed in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Volume 2A Installation of services* (DECC, 2008), *Volume 2C Unsealed roads* (DECC, 2008), *Volume 2D Main road construction* (DECC, 2008) and *Best Practice Erosion and Sediment Control* (IECA, 2008).

5.3.2 Operation and Decommissioning

Poor site stabilisation during and following construction would lead to impacts associated with the mobilisation of soil, as described in Section 5.3.1. This can be effectively managed through development of an ESCP and ongoing inspections and maintenance, in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Volume 2A, 2C and 2D* (DECC, 2008).

6. CUMULATIVE IMPACTS

In accordance with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE, 2022), cumulative impacts are a result of incremental, sustained and combined effects of human action and natural variations over time and can be both positive and negative. The accumulation of effects from past, current and future activities can result in cumulative impacts on surface and groundwater resources. When considered in isolation, impacts from specific projects may be considered minor or negligible, however, when multiple projects influence common receivers, the cumulative impact may be more significant.

The Project exists within the South West REZ, shown in Figure 6.1 (EnergyCo, 2024), which is intended to support 2.5 gigawatts of potential generation and storage projects.

6.1 Relevant Projects

A total of 15 known approved and proposed energy projects were identified from the NSW Government Major Projects website as being located within the vicinity (~60 km radius) of the Project. These include wind and solar projects, as well as a new electricity transmission line connecting South Australia, New South Wales and Victoria:

- Abercrombie Wind Farm (Proposed SSD-77340978).
- Baldon Wind Farm (Proposed SSD-40138508).
- Booroorban (Saltbush) Wind Farm (Proposed SSD-70636459).
- Bullawah Wind Farm (Proposed SSD-50505215).
- Hay Solar Farm (Approved SSD-8113).
- Keri Keri Wind Farm (Proposed SSD-38358962).
- Pottinger Solar Farm (Proposed SSD- 59254709).
- Pottinger Wind Farm (Proposed SSD-59235464).
- Tchelery Wind Farm (Proposed SSD-59701722).
- The Plains Wind Farm (Proposed SSD-50629707).
- Victoria to New South Wales Interconnector West (SSI-72887208).
- Wanganella Wind Farm (Proposed SSD-78102208).
- Wilan Wind Farm (Proposed SSD-51306206).
- West Nyangay Solar Farm (Proposed SSD-74990235).



FIGURE 6.1: SOUTH WEST RENEWABLE ENERGY ZONE

6.2 Potential Cumulative Impacts

The potential for cumulative impacts from the Project and adjacent known projects has been considered as presented in Table 6.1.

The abovementioned Projects are located within the Murrumbidgee surface water catchment, however, there is limited direct connectivity through watercourses. There is a mapped natural waterbody through the southwestern corner of the Project Site, which connects to an inland perennial swamp. There are no other direct interactions associated with this swamp and cumulative impacts are therefore anticipated to be negligible.

Similarly, no direct interactions with major watercourses and the Project are expected and would be limited to overland flow. Where indirect connections are identified, appropriate mitigation and management options are proposed. Therefore, cumulative impacts to surface water quality and flow are considered negligible.

TABLE 6.1: IDENTIFICATION OF CUMULATIVE IMPACTS

Category of Impact	Potential Cumulative Impact
Flooding	- Several projects are proposed within the Murrumbidgee catchment, however, none of which are directly connected to the Project Site via key watercourses. - Adjacent projects may interact with The Forest Creek, however, none of which are directly connected to the Project Site. - Impacts to The Forest Creek from the Project are anticipated to be negligible in events below the Extreme Event due to limited hydraulic connectivity and therefore cumulative impacts are considered negligible.

Category of Impact	Potential Cumulative Impact
Water Quality	Contamination of common receiving waterways (e.g. The Forest Creek) from erosion and sedimentation or contaminant/wastewater spills during overlapping construction periods is considered negligible provided the recommended mitigation measures are implemented.
Surface Water Supply	- Construction water supply would be in accordance with NSW licensing requirements and landholder rights, and therefore not contribute to cumulative impacts on surface water take. - Where rainwater is insufficient, potable water use would be supplemented with imported water. Overlapping project timelines may result in a cumulative impact to potable water supply, however, it is expected to be negligible in the context of the regional township water supply capacity. - Operational demands during operation would be limited to small amounts of potable water, and expected to be negligible in the context of the regional township water supply capacity.

7. MITIGATION AND MANAGEMENT MEASURES

Detailed environmental studies have been undertaken to inform the Project design, including the surface water assessments detailed in this SWIA. The consideration and outcomes of these studies in the design and integration with the approved operations minimise the potential for impacts on surface water resources.

The proposed mitigation measures for the Project are summarised in Table 7.1.

TABLE 7.1: SUMMARY OF POTENTIAL IMPACTS AND MITIGATION AND MANAGEMENT MEASURES

Potential Impacts	Mitigation Measure	Project Implementation Stage
WATERCOURSE CHARACTERISTICS		
Filling of streams for infrastructure / water crossings	Consider the following mitigation measures in the Project detailed design: - Limit water crossing to existing access tracks where possible. - Arrange Project infrastructure such that stream disturbance and modifications (filling / diversions) are limited to minor watercourses. In the event construction of waterway crossings is required, these would be designed, constructed and maintained to consider DPE <i>Guidelines for instream works on waterfront land</i> (DPE, 2022) and <i>Guidelines for riparian corridors on waterfront land</i> (DPE, 2022).	Detailed design
FLOODING		
Impacts to in-stream and overland flooding	Consider the following mitigation measures in the Project detailed design stage to minimise impacts to flooding possible: - Minimise filling of BESS, substations sites and on-site facilities. - Minimise extent of Project infrastructure within the 1% AEP flood extent. - Design to manage flood impacts and flow conveyance at watercourse crossings (if any).	Detailed design
Impacts on the Project design due to predicted flooding	Optimisation of the Project design during detailed design to ensure: permanent ancillary infrastructure (BESS/substation) is located above the flood planning level (1% AEP + 500 mm freeboard).	Detailed design
Impacts to site personnel during a flood event	Floodplain management planning to determine site management protocols during flood events that could impact construction or access areas, including: - Suitable early warning and communication protocols. - Triggers for closure, evacuation and recovery. - Emergency response and support.	Post Approval / Pre-construction

Potential Impacts	Mitigation Measure	Project Implementation Stage
Increased stormwater runoff from vegetation clearing and filling for infrastructure	Increased stormwater runoff during operations (due to clearing of vegetation and filling for infrastructure) would be managed through development of erosion and sediment control plan (ESCP). The ESCP should consider: • Location of site infrastructure away from existing watercourses or areas subject to high levels of overland flow. • Diversion of upstream flows around site infrastructure as required, to minimise scouring and erosion. • Inspection and monitoring regimes to maintain stormwater and erosion and sediment control structures.	Construction
WATER QUALITY		
Erosion and sedimentation of downstream watercourses	Development of erosion and sediment control plans (ESCP) through all project phases, in accordance with <i>Managing Urban Stormwater: Soils and Construction – Volume 1</i> (Landcom, 2004), <i>Volume 2A Installation of services</i> (DECC, 2008), <i>Volume 2C Unsealed roads</i> (DECC, 2008), <i>Volume 2D Main road construction</i> (DECC, 2008) and <i>Best Practice Erosion and Sediment Control</i> (IECA, 2008). The ESCPs would detail area specific erosion and sediment control measures to be implemented and maintained during construction until the design intent is met by the as-built infrastructure and rehabilitated vegetation. As well as ongoing monitoring and maintenance through operation and decommissioning of additional controls if identified as required. The total area of disturbance at any time should be minimised where possible and ongoing rehabilitation and stabilisation strategies implemented throughout construction.	Construction
Release of sediment or construction by-products	During construction, the following management measures would be considered to minimise the potential for mobilisation of sediment or dust from topsoil stockpile: • Locate stockpiles away from drainage lines, or areas subject to high levels of overland sheet flow and minimise stockpile size. • Develop and implement area specific erosion and sediment control measures including bunding and diversion drains as required. • Use stockpile stabilisation techniques such as covering or dust suppression.	Construction
Contaminant spills	Prior to commencing construction activities, a Construction Environment Management Plan (CEMP) would be developed to identify site specific controls and procedures to minimise the potential for hydrocarbons and other contaminants being discharged into the environment. This CEMP should consider: • Storage of hydrocarbons and other liquid chemicals within an above ground, bunded areas away from watercourses or area subject to high levels of overland sheet flow. • Re-fuelling of construction vehicles and equipment to be limited to designated areas, with adequate spill management controls. • Maintain an emergency spill kit and relevant emergency spill response procedures. • Transport and dispose of any hydrocarbons captured during Project construction and operation of the substations and switchyards at a suitable off-site licenced facility.	Construction, Operation

Potential Impacts	Mitigation Measure	Project Implementation Stage
Surface water and groundwater quality impacts	The CEMP would consider the following management measures to minimise the potential impacts to surface water and groundwater quality within and surrounding the Project Site: • Develop and implement a suitable monitoring regime of all stormwater and erosion and sediment control structures, particularly following large flow events.	Construction, Decommissioning
WATER SUPPLY		
Water licences to meet demands	All required water licensing and approvals would be coordinated with associated landholders and/or regulators (e.g. Council, others) if that source is needed to support water supply arrangements for during construction and operation.	Post Approval (Construction, Operation)
WASTEWATER MANAGEMENT		
Discharge of wastewater or effluent from site	Design and implement a wastewater treatment system that: • Is appropriately sized for the Project infrastructure and operations. • Collects and treats wastewater from site offices and temporary accommodation facilities for re-use on site to fulfill non-potable construction and operation demands. • Be designed and operated in accordance with best practices.	Detailed design

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9. QUALIFICATIONS

- (a) In preparing this document, including all relevant calculation and modelling, Engeny Australia Pty Ltd (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.
- (b) Engeny has used reasonable endeavours to inform itself of the parameters and requirements of the project and has taken reasonable steps to ensure that the works and document is as accurate and comprehensive as possible given the information upon which it has been based including information that may have been provided or obtained by any third party or external sources which has not been independently verified.
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APPENDIX A: HYDRAULIC MODEL BASIS OF MODELLING





Romani BESS

Hydraulic Model Basis of Modelling

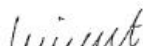
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25 AUGUST 2025

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Rev	Date	Description	Author	Reviewer	Project Mgr.	Approver
0	5/09/2024	Client Issue	R. Srinivasan	S. Willis	L. Vincent	S. Shield
1	15/10/2024	Client Issue	R. Srinivasan	S. Willis	L. Vincent	S. Shield
2	20/05/2025	Client Issue	R. Srinivasan	S. Willis	L. Vincent	S. Shield
3	20/06/2025	Client Issue	R. Srinivasan	S. Willis	L. Vincent	S. Shield
3	25/08/2025	Client Issue	R. Srinivasan	S. Willis	L. Vincent	S. Shield
Signatures:						

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1. INTRODUCTION

1.1 Assessment Scope

Engeny Australia Pty Ltd (Engeny) has been engaged to complete a flooding and hydrology assessment to support the Environmental Impact Statement (EIS) by developing a Surface Water Impact Assessment (SWIA) report for the Romani BESS (the Project), the location of which is provided in Figure 1.1. This assessment is to include detailed flood modelling of the Project Site so that existing overland flow behaviours can be understood. This information will also assist the proponent in the placement of project infrastructure to minimise potential flood impacts.

The approach to the flood modelling was to develop a flood model(s) that is suitable for the flood assessment of the Project. As such, the primary objective of the flood modelling is to define the flood behaviour within and around the proposed Project Site. The assessment will:

- Consider the potential influences of dams/water storages on third party (i.e., privately owned) land both within and downstream of the Project Site.
- Establish existing hydraulic performance (for the 5% and 1% Annual Exceedance Probability (AEP) events, and the probable maximum flood (PMF) or an equivalent extreme flood event), flow regimes and erosion susceptibility using the two-dimensional hydraulic model (TUFLOW). Identify potential impacts the BESS Project design may have on flooding / overland flows with consideration of blockage of flow path areas by the panels, and blockage associated with site boundary fences.
- For the current baseline conditions, two climate change representative scenarios will be assessed (i.e., the 0.5% and 0.2% AEP year flood events). These will be assessed for the same critical durations and temporal patterns as the 1% AEP event. This will enable an understanding of the potential impacts of climate change and as such help inform the approach to any potential flood risks.



FIGURE 1.1: PROJECT LOCATION

2. FLOOD MODEL INPUT DATA

2.1 Topography

The Digital Elevation Model (DEM) for the Romani BESS Project Site and the contributing upstream catchment has been compiled from the following sources in order of priority:

- 1 m and 5 m NSW LPI LiDAR (flown between 2011 – 2022), collected from ELVIS (<https://elevation.fsdf.org.au/>).

2.2 Aerial Imagery

Aerial imagery was sourced from ArcGIS online Esri Imagery and Google Maps.

2.3 Relevant Studies

The following relevant studies and documents were reviewed:

- *Murrumbidgee River at Darlington Point and Environs Flood Study* (BMT, 2018)
- *Hay Sun Farm Environmental Impact Statement* (EMM, 2017)
- *Yanco Delta Wind Farm: Technical Report – Flooding and Hydrology* (Jacobs, 2022)
- *The Plains Solar Farm and BESS Environment Impact Statement Technical Paper: Flooding* (Lyall & Associates, 2024)

3. FLOOD MODEL APPROACH

3.1 Overview

Local overland flow paths and flooding regimes (i.e., within the Project Site and the mapped watercourses that are within the Project Site) will be assessed using hydraulic modelling in TUFLOW using its 'Rain-on-Grid' (RoG) modelling approach. The local catchments will be modelled to determine overland flow path/flood extents, depths, velocities, etc. through and around the Project Site

3.2 The Murrumbidgee River Influence

The Project Site is situated within the Murrumbidgee River floodplain, specifically located 35km south of the river, as shown in Figure 1.1. As the site is located within the floodplain, it is anticipated that during an event which engages the Murrumbidgee River, flows will breakout and engage the surrounding floodplain, potentially impacting the site.

This has been demonstrated in an existing EIS undertaken for a solar farm within the Murrumbidgee floodplain, such as Lyall & Associates 'The Plains Solar Farm and BESS Environment Impact Statement Technical Paper: Flooding', dated February 2024 (ref. GO583 Rev 1.3). This investigation identified that the Plains Solar Farm, which is located approximately 31 km north east of the Project Site, was subject to riverine flooding when an event occurred within the Murrumbidgee River, due to flows breaking out of the Murrumbidgee River between Narrandera and Darlington Point, within the 1% AEP and PMF events. However, this study also investigated the impacts of local flooding, due to direct rainfall on the catchment upstream of the Plains Solar Farm and determined that this resulted in the worst case flooding conditions for the floodplain. No coincidence event was investigated, as the chance of this occurring was deemed to be extremely rare.

Therefore, the hydrology and flooding assessment for the EIS will exclude the detailed investigation of riverine flooding due to the Murrumbidgee River, as it is understood that the local contributing catchment plays a more significant role in impacts to the floodplain. Impacts of riverine flooding will be considered during post approval as required and will be incorporated for the detailed design of the site infrastructure and the Emergency Response Plan.

3.3 Model Approach and Extents

The overall modelling approach involves development of two separate TUFLOW models:

- (1) Regional Catchment Model
- (2) Local Project Model

3.3.1 Regional Catchment Model

The total Project Site associated with the proposed BESS is 0.2 km². The potential upstream catchment area contributing to the Project Site, however, is much larger (~7500 km²). Therefore, to reduce model simulation time, while maintaining a suitable level of detail within and around the Project Site, it is proposed to develop a larger RoG model to determine inflow hydrographs to the Project Site from the large upstream catchment. The Regional Catchment Model boundary is shown in Figure 3.1.

3.3.2 Local Project Model

This involves a more detailed RoG TUFLOW model of the Project Site and surrounds. Upstream inflows, which are not expected to change between the existing and proposed conditions, will be applied from the results of the Regional Catchment Model. The Local Project Model boundary is shown in Figure 3.2.

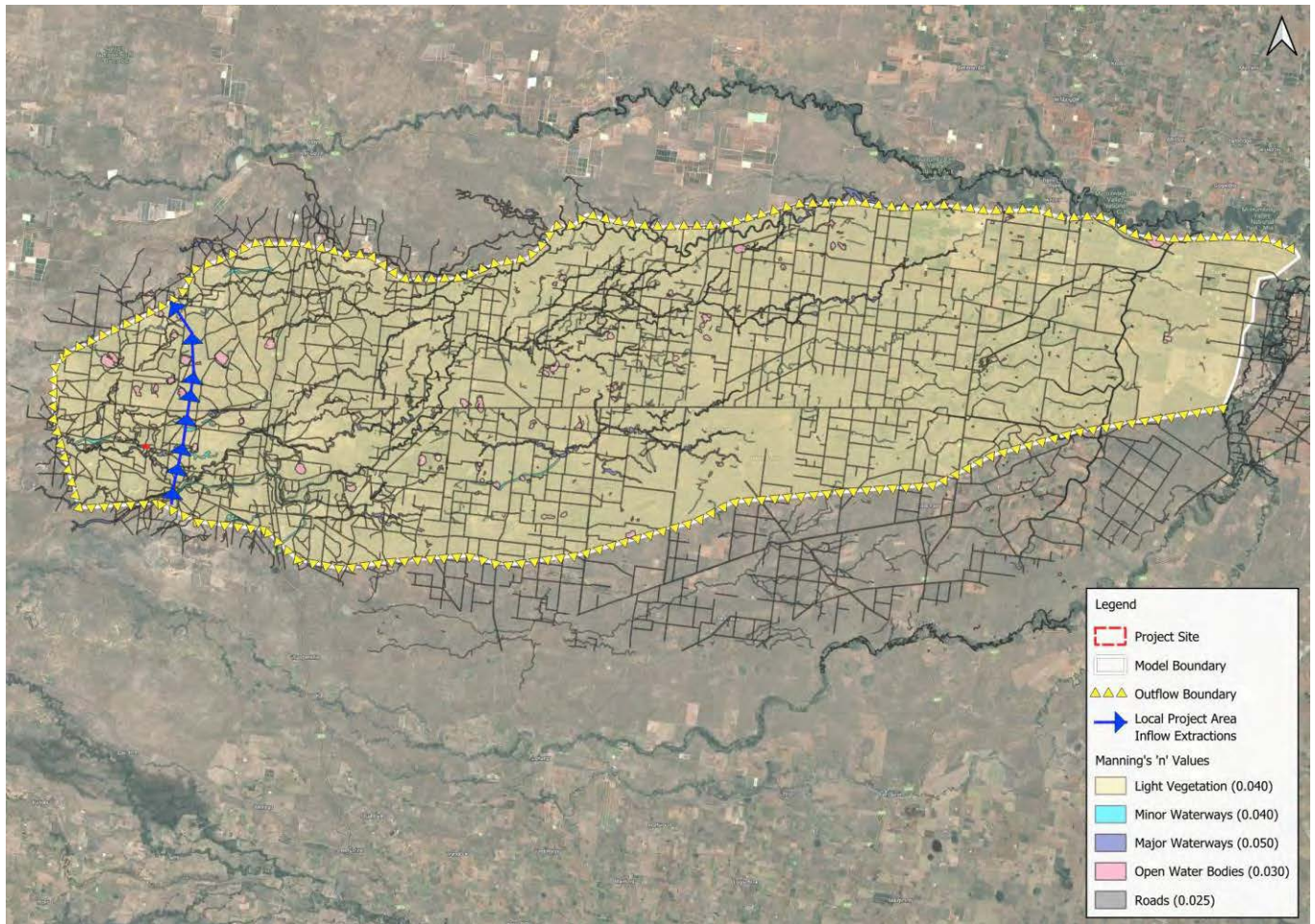


FIGURE 3.1: REGIONAL CATCHMENT MODEL TUFLOW BOUNDARY

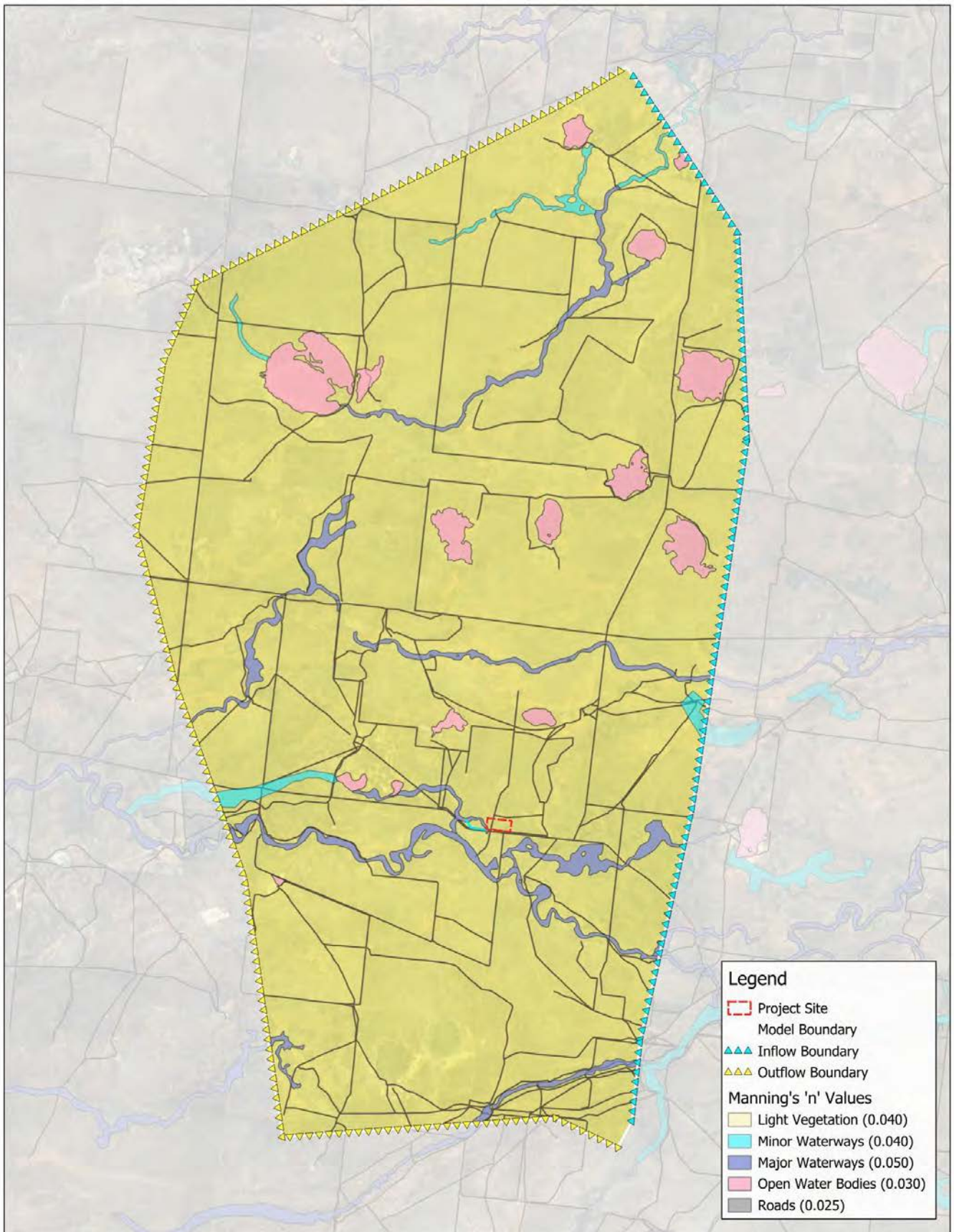


FIGURE 3.2: LOCAL PROJECT MODEL TUFLOW BOUNDARY

3.4 Hydrology

3.4.1 Design Rainfall

The Australian Rainfall and Runoff (ARR) BOM design rainfall data for the Romani BESS hydrology models was derived for the 5%, 1%, 0.5% and 0.2% AEP rainfall events. Rainfall totals for these AEPs were generated through the online ARR Data Hub (BoM, 2022) and defined within TUFLOW across the model domain, using latitude/longitude coordinates of -34.812, 145.347.

3.4.2 Extreme Flood / PMF Estimation

In accordance with recommended environmental assessment requirements for the Project from the NSW Biodiversity and Conservation Division, the flood modelling includes a range of flood events up to and the Probable Maximum Flood (PMF), or an equivalent extreme flood event.

Due to the relatively flat nature of the terrain upstream and surrounding the Project Site, a RoG (lumped hydrology and hydraulic) TUFLOW model approach was used, rather than a separate hydrologic model. The PMF flood event using the standard Probable Maximum Precipitation (PMP) method outlined in ARR is therefore not possible.

The “Extreme” flood terminology was adopted and represents an approximate PMF flood event. The Extreme event methodology adopted in this flood assessment is three times larger than the 1% AEP flow. This is consistent with other flood studies in the region, including on the Murrumbidgee River at Darlington Point (BMT, 2018) and a standard approach for larger systems, such as the upstream catchment for the Project Site.

3.4.3 Temporal Patterns

An ensemble temporal pattern approach was adopted. Book 4 ‘Catchment Simulation for Design Flood Estimation’, Chapter 3 ‘Types of Simulation Approaches’ of the Australian Rainfall and Runoff (ARR19) (Ball, et al., 2019) recommends consideration of several different temporal patterns and adopting the median of these events.

Predominantly within the industry the ensemble approach is adopted as it is considered that a sample of 10 storms provides sufficient statistical variance for the temporal pattern to determine a median storm that considers the influence of the temporal patterns on the catchment, while not needing to undertake the expensive and time-consuming approach of a Monte Carlo assessment.

However, for the purposes of an overland flow study (such as the Regional Catchment Model), this high level of statistical robustness it is not necessarily required. Key temporal patterns were assessed to consider the influence of different storms to provide robustness of the final adopted mapping and flood outputs. This process was used to demonstrate the small variance in the final predicted levels from overland flow. The selection of temporal patterns included:

- a mid-loaded storm;
- a front-loaded storm; and
- a back-loaded storm.

Figure 3.5 shows an example of selection of a mid-loaded (red), back-loaded (green) and front-loaded (purple) temporal pattern. The selected temporal patterns are provided in Table 3.1.

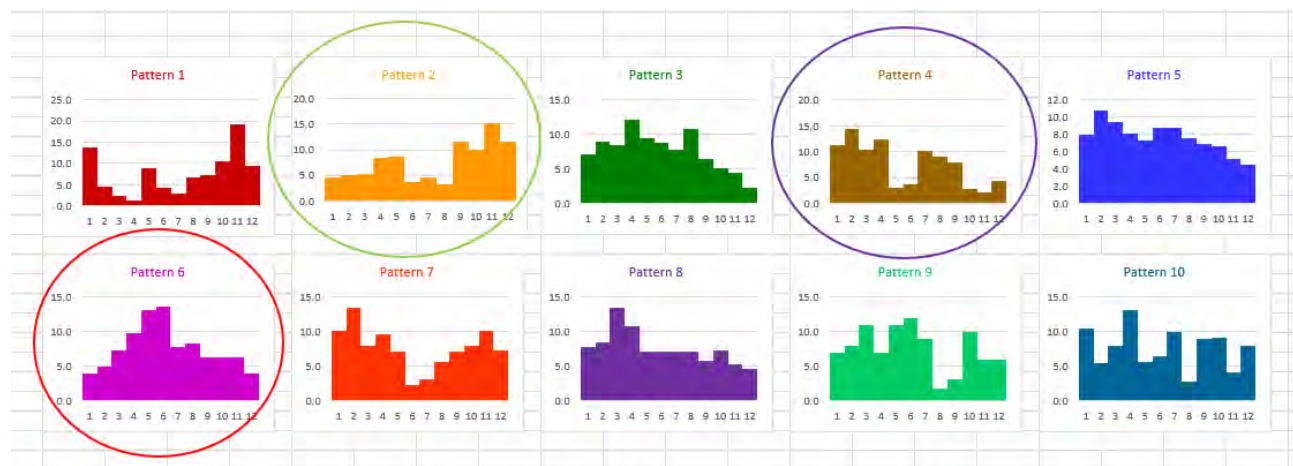


FIGURE 3.3: SELECTION OF TEMPORAL PATTERNS

Temporal patterns for the 5% AEP and 1% design storms were adopted from the ensemble temporal patterns for “Murray Basin” sourced from ARR Data Hub. The ensemble result closest to the average of all ensemble results was adopted as the design flood estimate.

As the Extreme event (PMF equivalent) was modelled based on 3 x 1% AEP flows, the critical 1% AEP temporal pattern was adopted.

TABLE 3.1: SELECTED TEMPORAL PATTERNS

Storm Duration (hours)	Front-loaded	Mid-loaded	Back-loaded
24	6	7	3
36	9	5	6
48	4	10	1
72	3	9	8
96	3	5	8
120	3	1	7
144	5	7	9
168	5	8	4

3.4.4 Areal Reduction Factors

The areal reduction factor (ARF) is a multiplier applied to the design rainfall to account for increased spatial variability that occurs over larger catchments. The ARF is calculated using region specific parameters and the total catchment area upstream of the Project Site. Calculation of storm ARF within the model catchments is proposed to be based on the methodology for catchments between 10 km² and 1,000 km² (Romani BESS Local Sub Model) and between 1,000 km² and 30,000 km² (Regional Inflow Model) in accordance with ARR2019 recommendations (Book 2, Chapter 4, Section 4.3), using ARF parameters for the Southern Semi-arid Zone (refer Table 2.4.2 of ARR2019, Book 2, Chapter 4).

3.4.5 Rainfall Losses

Design rainfall losses will be sourced from the ARR Data Hub (BoM, 2022) for the RoG TUFLOW models, as summarised in Table 3.2. In accordance with the ARR2019 Guidelines (Ball, et al., 2019), values of 1 mm for initial loss and 0 mm/hr for continuing loss were adopted for the Extreme (PMF equivalent) event. The median pre-burst rainfall depths sourced from the ARR Data Hub (<http://data.arr-software.org>) are then subtracted from the initial storm loss to produce the design storm burst loss.

TABLE 3.2: RAINFALL LOSSES

Parameter	Regional Catchment Model	Local Project Model
Initial Loss (mm)	42.0	62.0
Continuing Loss (mm/hr)	0	0

3.4.6 Model Validation

Due to the lack of gauged flood/flow data in the region, except on the major rivers systems, the flood model cannot be calibrated to historical data.

3.5 Hydraulics

3.5.1 Grid Size

The model extents for each TUFLOW model were delineated to capture all flood events and their anticipated wetted areas upstream, downstream and throughout the Romani BESS Project Site and are discussed in Section 3.2.

A cell size of 60 m, with a 10 m sub-grid sampling (SGS) size will be adopted for the Region Catchment Model. SGS is an improved modelling methodology that allows for simulation of larger grid cell sizes to be completed without losing model accuracy. Furthermore, TUFLOW recommends the adoption of this for large scale RoG models, as SGS allows for flow to not be trapped by poor model topography.

A smaller cell size of 20 m, with a 10 m SGS size was adopted in the Local Project Model to allow detailed representation of the site features.

3.5.2 Model Inflows

Due to the nature of RoG models, no discrete inflow boundaries have been included in the Regional Inflow Model. Rather, design rainfall has been spatially distributed across the model terrain within the RoG model.

For the Local Project Model, cumulative inflow hydrographs, extracted from the Regional Catchment Model, were applied at the upstream boundaries. Local catchment flows within the Local Project Model domain were spatially distributed using the RoG method.

3.5.3 Downstream Boundaries

The outflow boundary conditions for the TUFLOW models were represented as a normal depth based on low flow channel grades at the downstream extent of the models. These boundaries are located a sufficient distance downstream to not influence the flood behaviour onsite. Downstream boundaries were applied to the TUFLOW model to allow flow to exit the model area.

For the Regional Study, this is approximately 15 km downstream of the upstream end of the Project Site. For the Local Study, this is approximately 5 km downstream of the Project Site.

3.5.4 Hydraulic Roughness

The hydraulic Manning's roughness coefficients used in the model are based on visual observation of aerial photography of the site as well as identifiable features in the proposed infrastructure layouts. Proposed roughness values are in accordance with previous studies in the area and have been tabulated in Table 3.3. These values have been adopted for the Regional Inflow Model and will be revised if changed for the Romani BESS Local Sub Model.

TABLE 3.3: PROPOSED HYDRAULIC ROUGHNESS VALUES

Land Use Type	Manning's 'n' Value
Open Water Bodies	0.030
Minor Waterways	0.040
Major Waterways	0.050
Light Vegetation	0.040
Dense Vegetation	0.075
Crops	0.060
Roads	0.025

4. HYDRAULIC RESULTS

The outcomes of the local flood model will be prepared to the following inputs for the SWIA:

- Flood mapping of all simulated events for the flood depth, velocities and hazard categories.
- Defining the drainage paths and flood extents within the site boundary, to support placement of site infrastructure.
- Assessment of the potential impacts the Project may have on overland flow behaviour from the baseline scenario.

5. REFERENCES

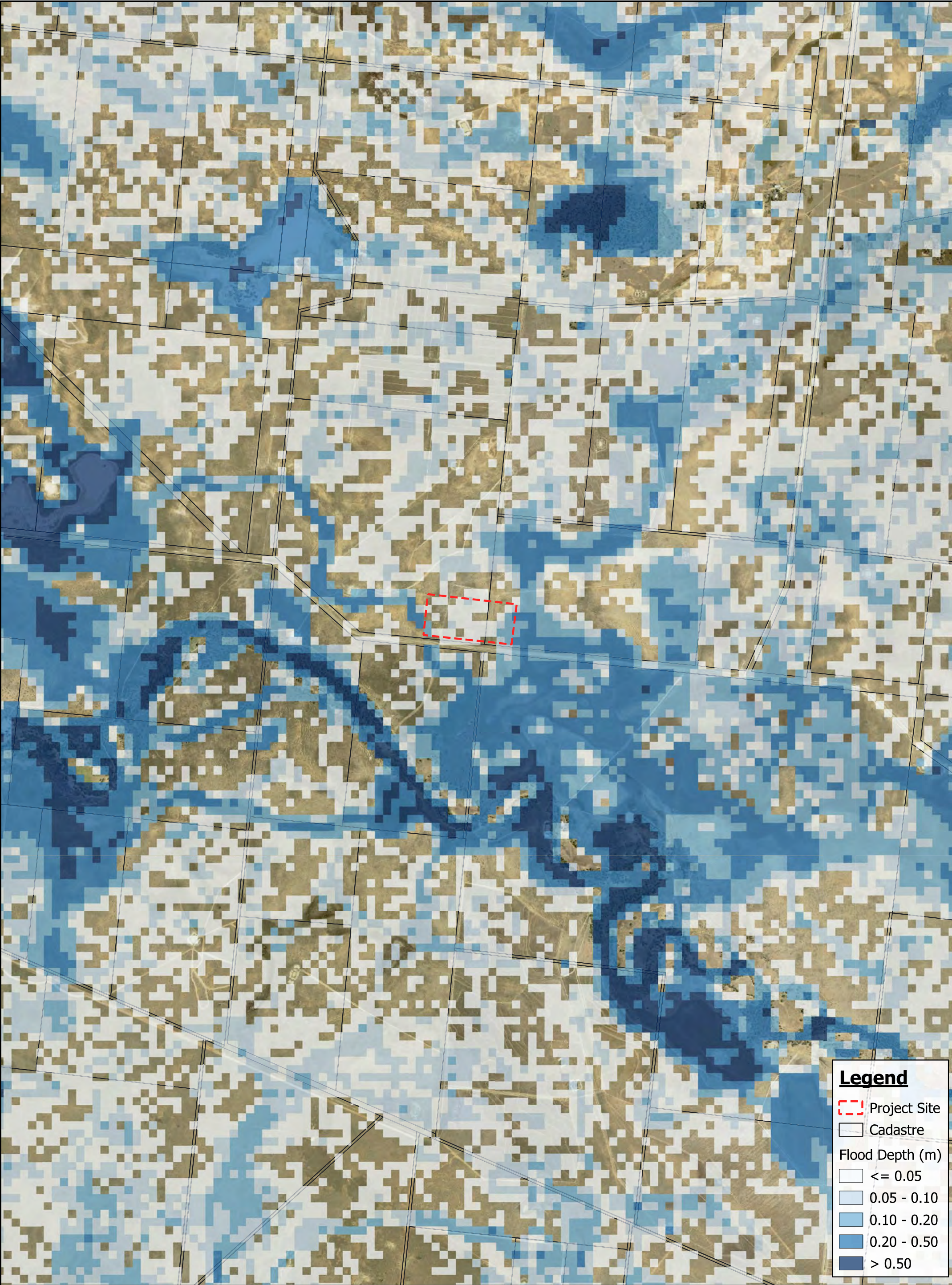
- Ball, J., Babister, M., Nathan, R., Weeks, W., Weinmann, E., Retallick, M., & Testoni, I. (2019). *Australian Rainfall and Runoff: A Guide to Flood Estimation*. Commonwealth of Australia (Geoscience Australia).
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- EMM. (2017). *Hay Sun Farm Environmental Impact Statement*.
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- Lyall & Associates. (2024). *The Plains Solar Farm and BESS Environmental Impact Statement Technical Paper: Flooding*.
- Willis, S. (2024). *Providence FMS*. Brisbane.

6. QUALIFICATIONS

- (a) In preparing this document, including all relevant calculation and modelling, Engeny Australia Pty Ltd (Engeny) has exercised the degree of skill, care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering principles.
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APPENDIX B: EXISTING CONDITION FLOOD MODEL RESULTS





Legend

Project Site

Cadastre

Flood Depth (m)

≤ 0.05

0.05 - 0.10

0.10 - 0.20

0.20 - 0.50

> 0.50

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1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

0

200

400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

DISCLAIMER

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DATA SOURCE

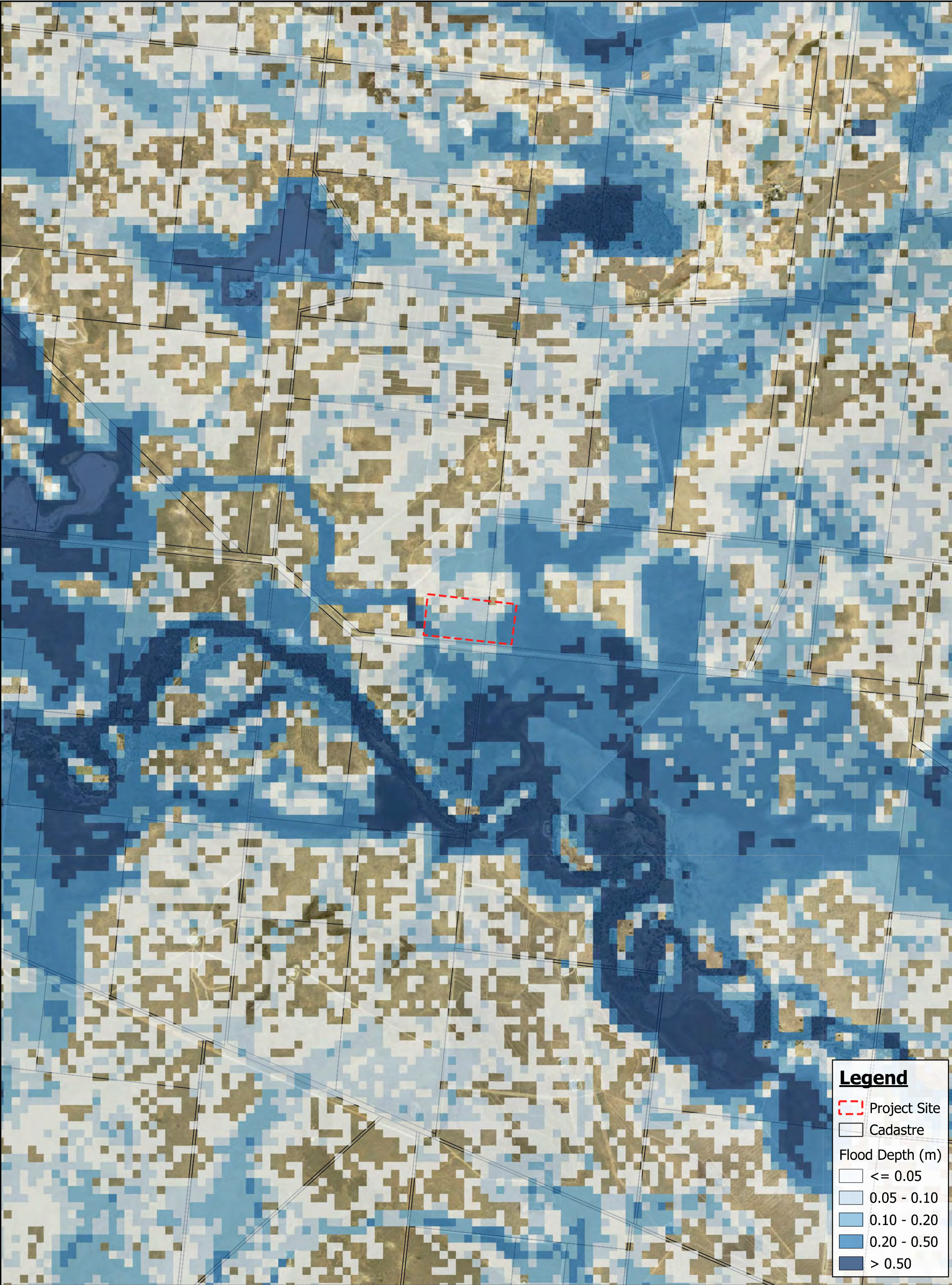
NSW Government Open Data Source



Appendix B1 - 5% AEP Flood Depth

Romani BESS
Baseline Results

Drg Ref.



Legend

Project Site

Cadastre

Flood Depth (m)

<= 0.05

0.05 - 0.10

0.10 - 0.20

0.20 - 0.50

> 0.50

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

N

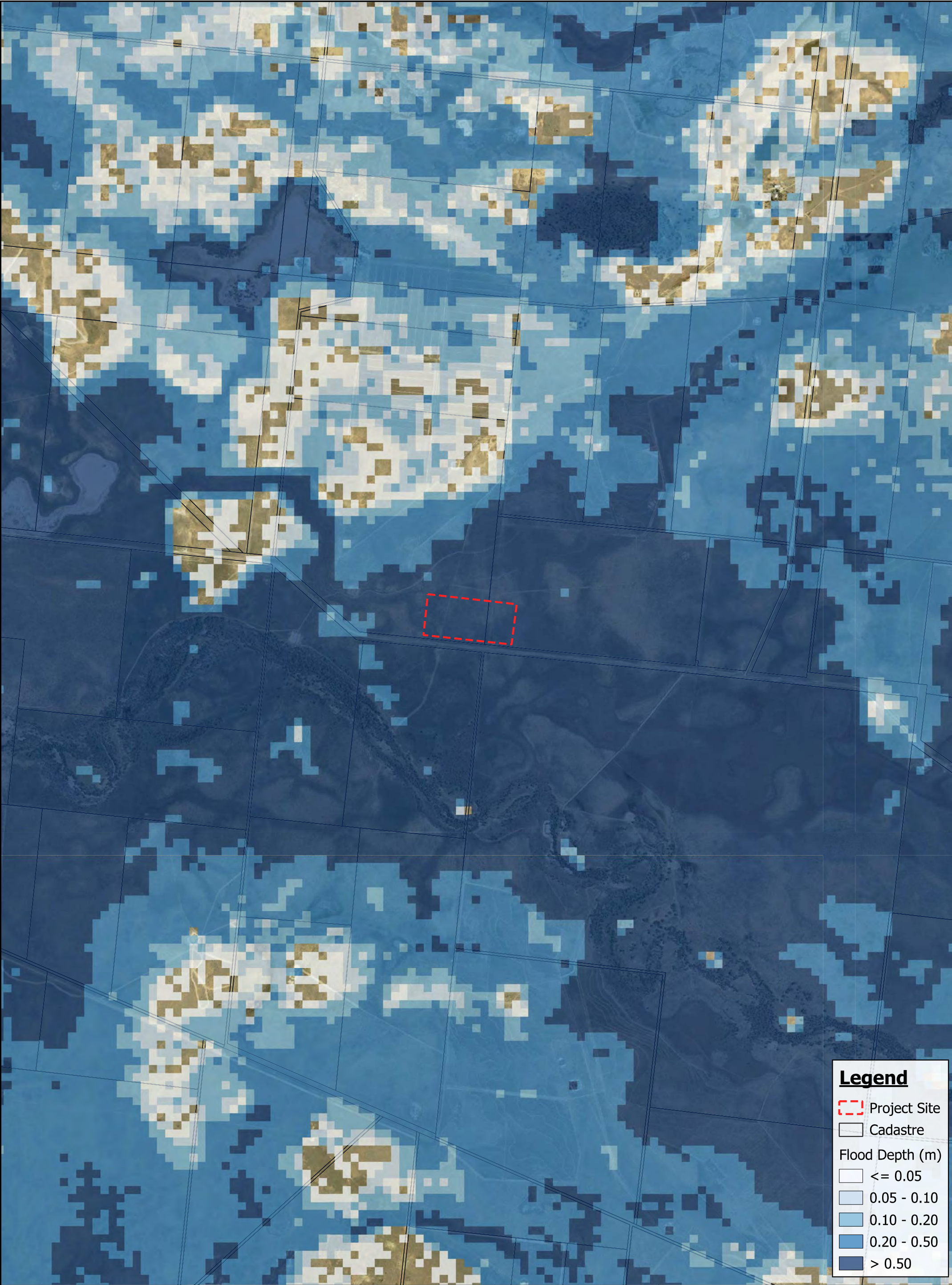
0200400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

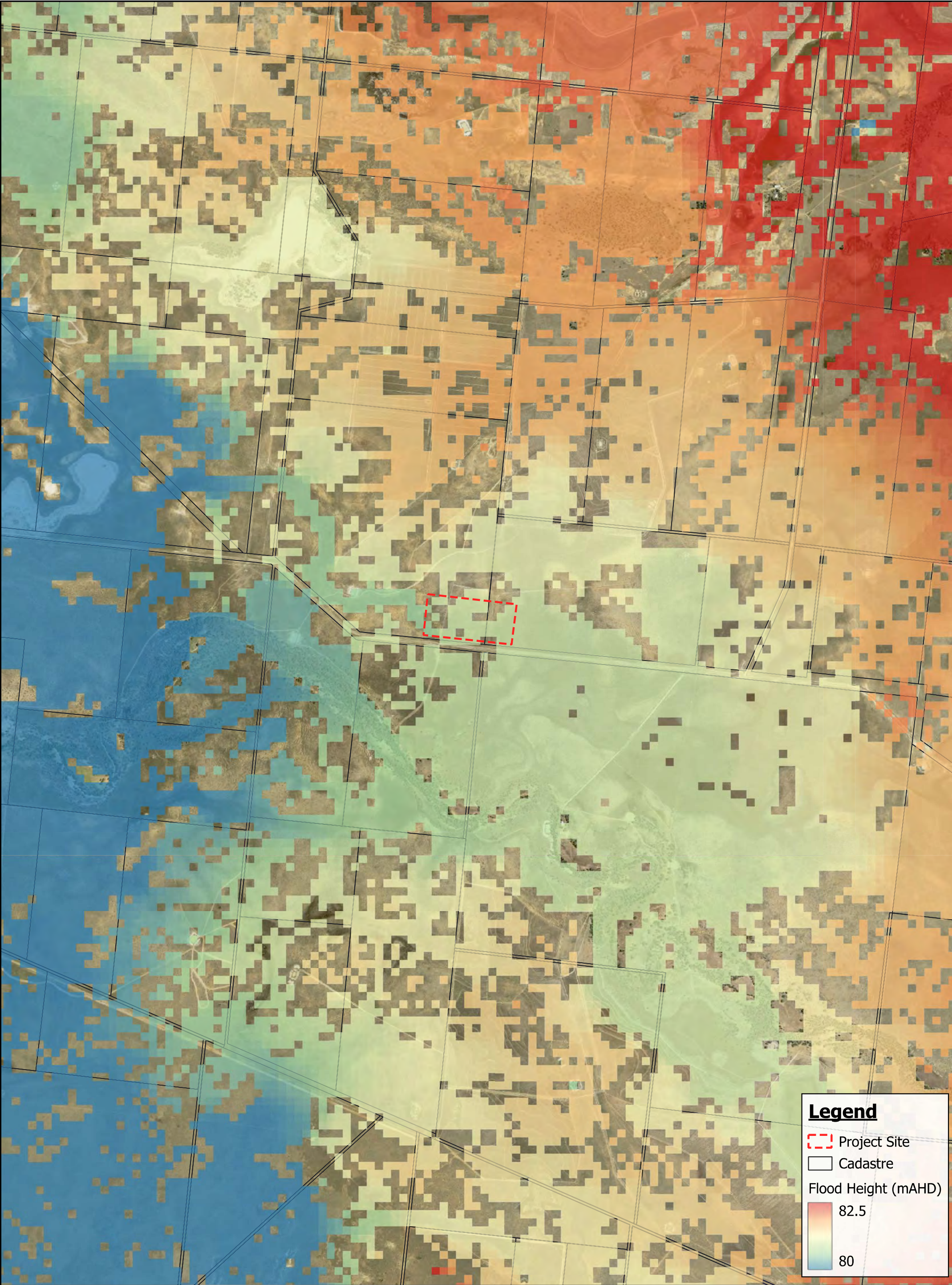
DISCLAIMER
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DATA SOURCE
NSW Government Open Data Source

Appendix B2 - 1% AEP Flood Depth
Romani BESS Baseline Results
Drg Ref.

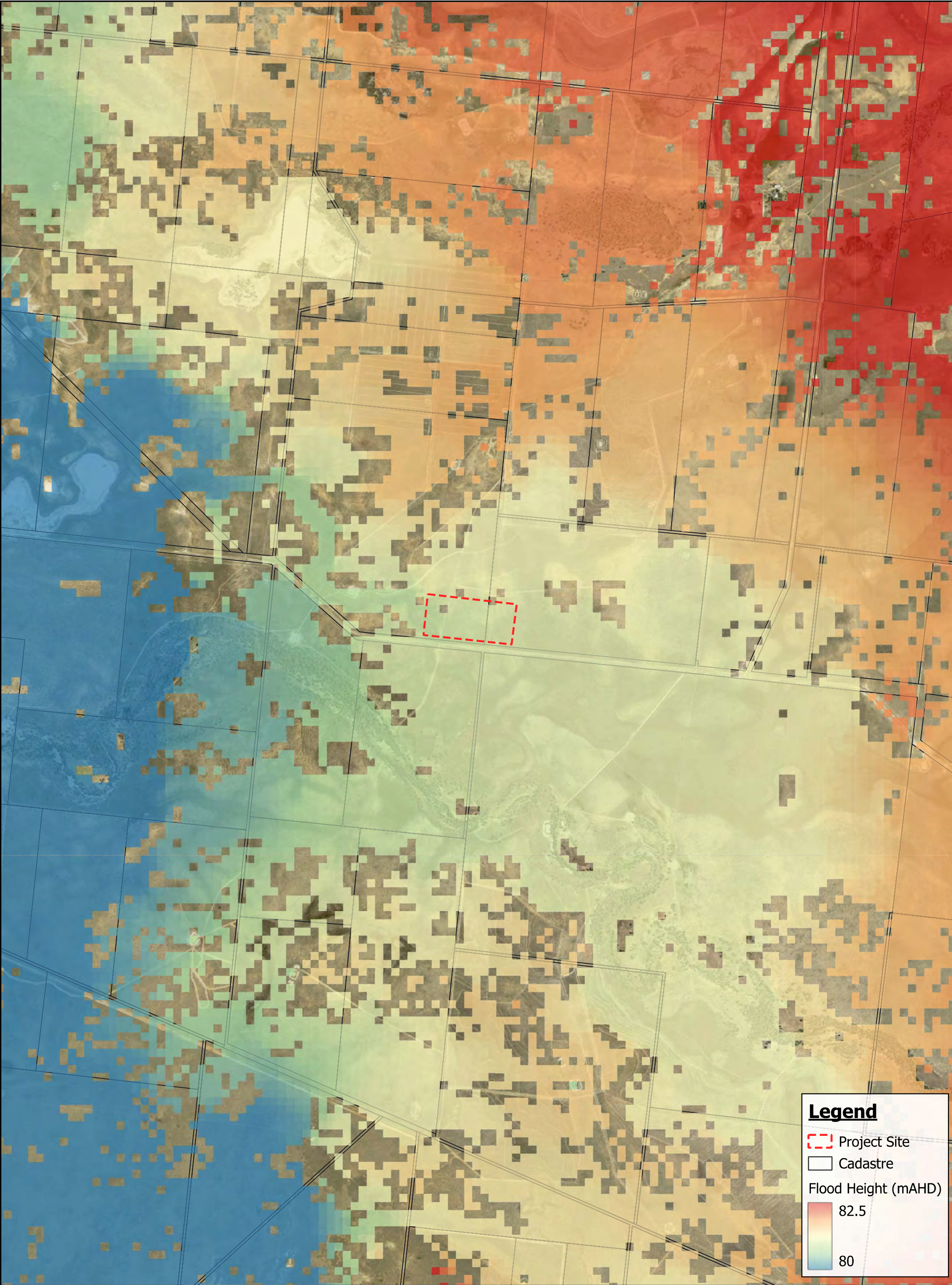


R DETAILS		DATE		© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.				 0 200 400 m SCALE @ A3 - 1:25,000 GDA2020 / MGA zone 55	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source	 	Appendix B3 - PMF Flood Depth	
1 Final Issue		25-08-2025									Romani BESS Baseline Results	
				DRAWN SW CHECKED LV								
				APPROVED SS DATE 25-08-2025								
				NOTES:								
								Drg Ref.				



R DETAILS		DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

 0 200 400 m	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source			Appendix B4 - 5% AEP Flood Height
SCALE @ A3 - 1:25,000 GDA2020 / MGA zone 55				Romani BESS Baseline Results
				Drg Ref.



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1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

0 200 400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

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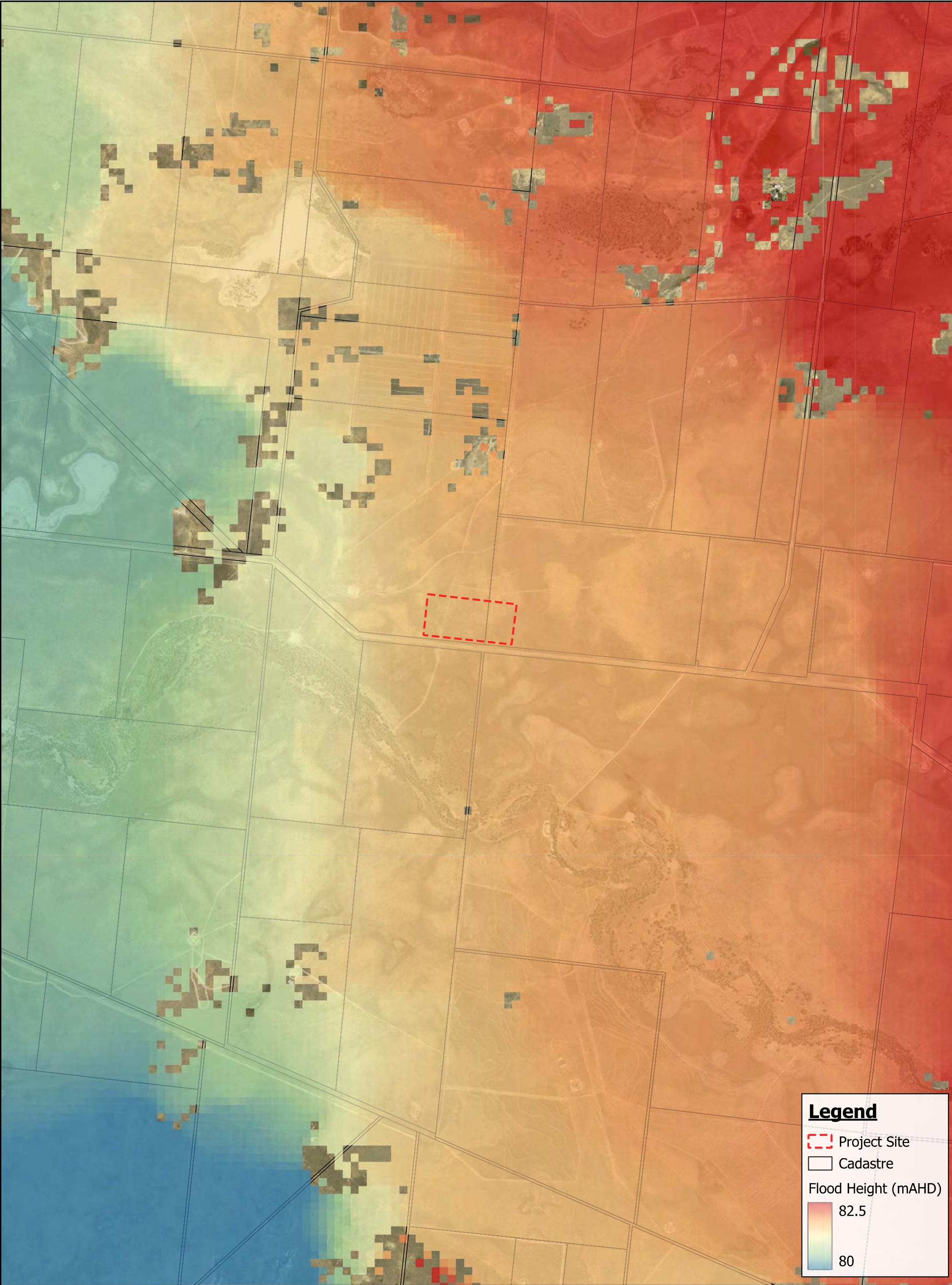
DATA SOURCE

NSW Government Open Data Source

Appendix B5 - 1% AEP Flood Height

Romani BESS
Baseline Results

Drg Ref.



R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

N

0200400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

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DATA SOURCE
NSW Government Open Data Source



Appendix B6 - PMF Flood Height
Romani BESS Baseline Results
Drg Ref.



Legend

Project Site

Cadastre

Flood Velocity (m/s)

≤ 0.1

0.1 - 0.2

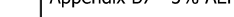
0.2 - 0.5

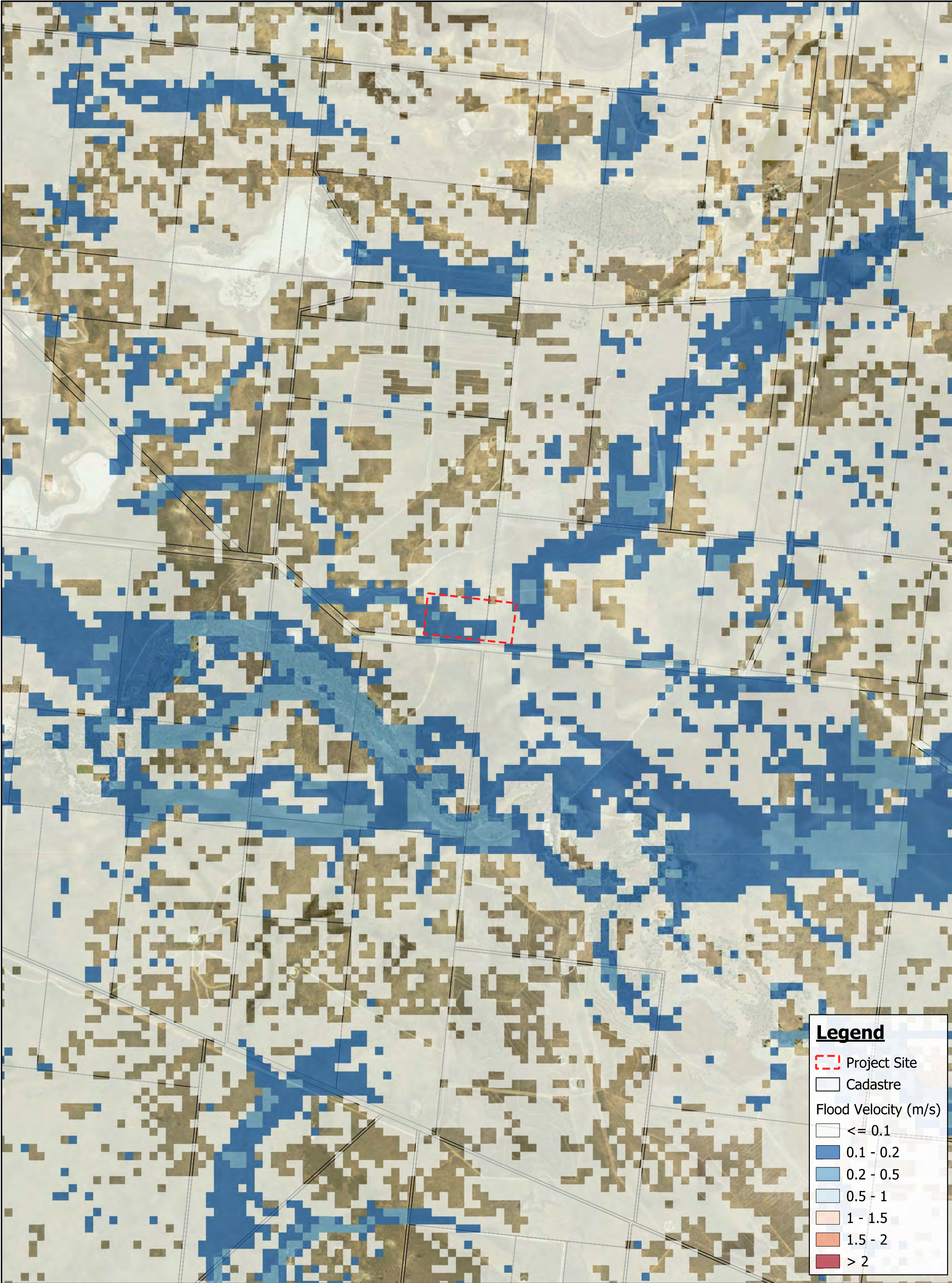
0.5 - 1

1 - 1.5

1.5 - 2

> 2

R		DETAILS		DATE		© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.		 0 200 400 m	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source	 ENGENY		Appendix B7 - 5% AEP Flood Velocity			
1		Final Issue		25-08-2025		DRAWN	SW					CHECKED	LV	Romani BESS Baseline Results	
						APPROVED	SS					DATE	25-08-2025		
						NOTES:									
												Drg Ref.			



Legend

Project Site

Cadastre

Flood Velocity (m/s)

≤ 0.1

0.1 - 0.2

0.2 - 0.5

0.5 - 1

1 - 1.5

1.5 - 2

> 2

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

0

200

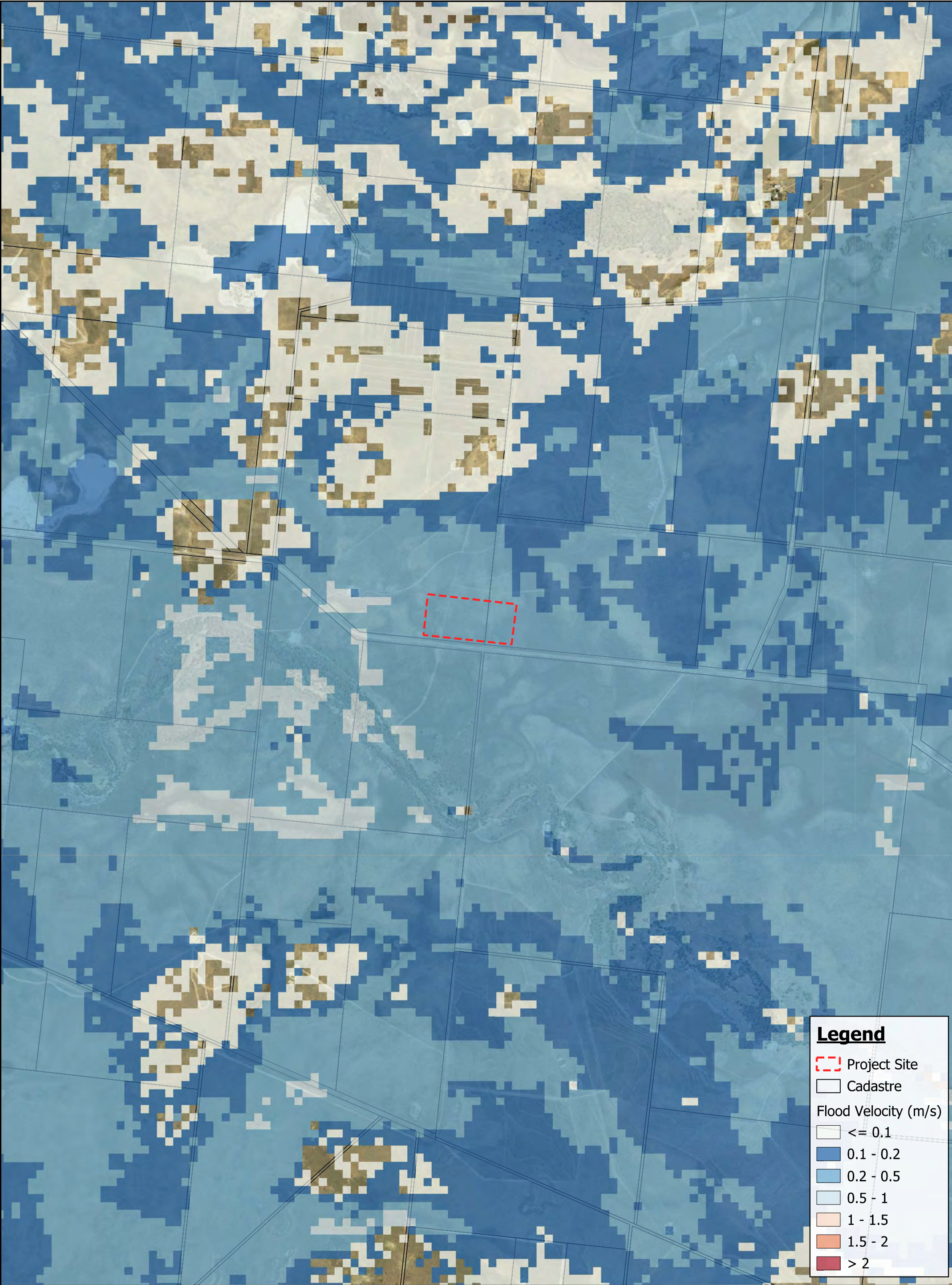
400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

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DATA SOURCE
NSW Government Open Data Source

Appendix B8 - 1% AEP Flood Velocity
Romani BESS Baseline Results
Drg Ref.



Legend

 Project Site

 Cadastre

Flood Velocity (m/s)

 <= 0.1

 0.1 - 0.2

 0.2 - 0.5

 0.5 - 1

 1 - 1.5

 1.5 - 2

 > 2

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			


0 200 400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

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DATA SOURCE
NSW Government Open Data Source

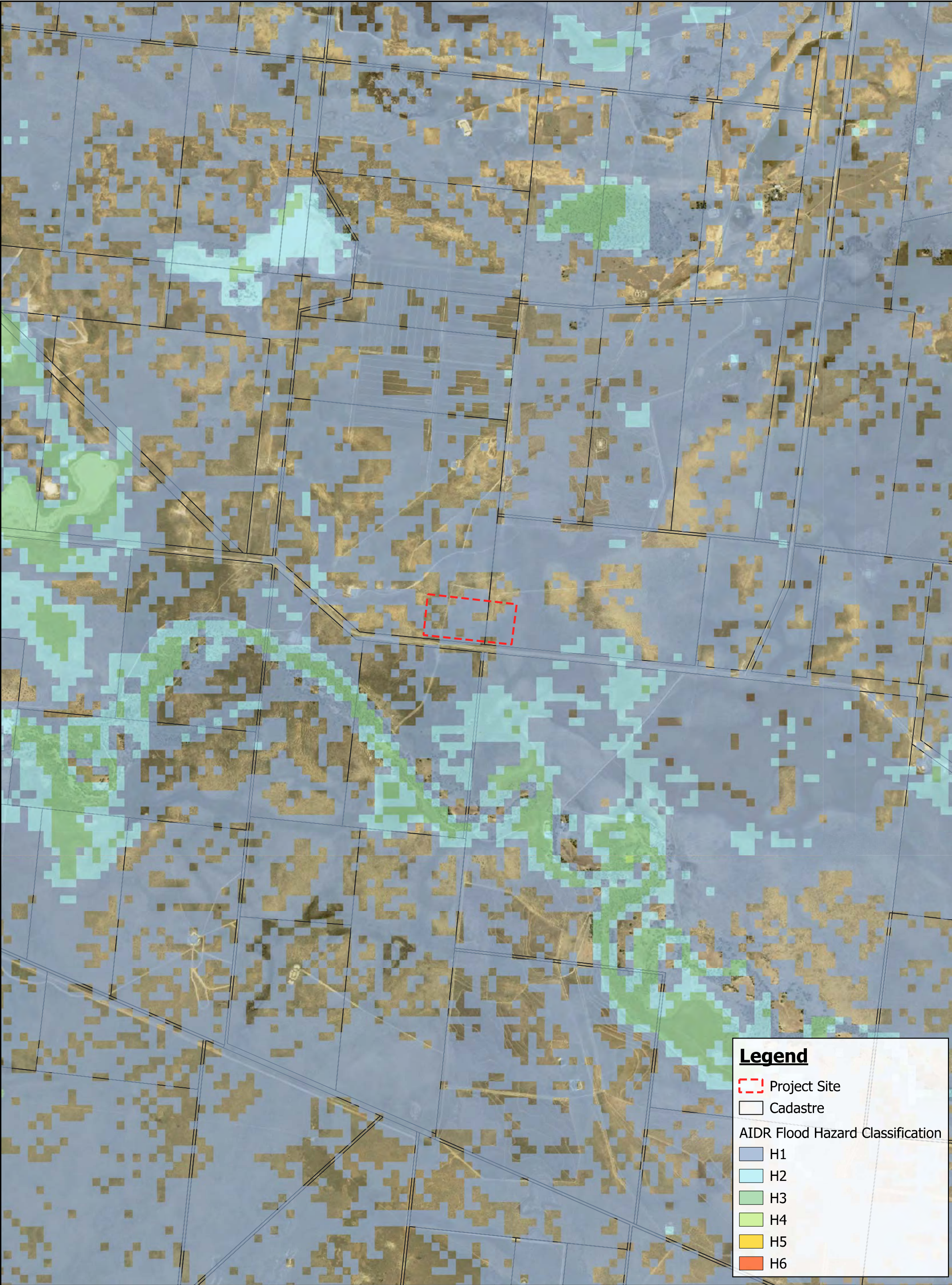




Appendix B9 - PMF Flood Velocity

Romani BESS
Baseline Results

Drg Ref.



Legend

Project Site

Cadastre

AIDR Flood Hazard Classification

H1

H2

H3

H4

H5

H6

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

N

0

200

400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

DISCLAIMER

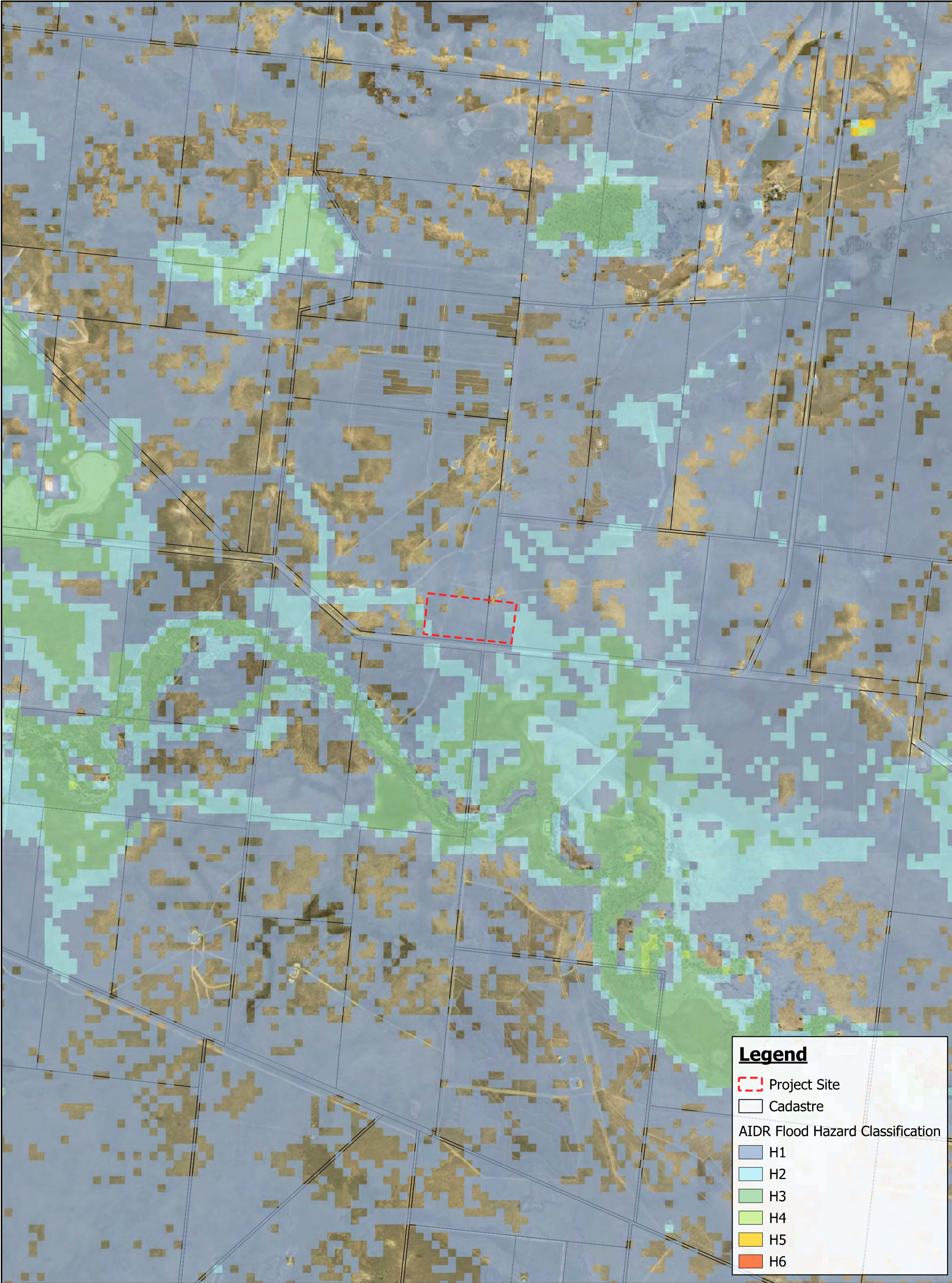
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DATA SOURCE

NSW Government Open Data Source



Appendix B10 - 5% AEP Flood Hazard
Romani BESS Baseline Results
Drg Ref.



Legend

Project Site

Cadastre

AIDR Flood Hazard Classification

H1

H2

H3

H4

H5

H6

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

N

0200400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

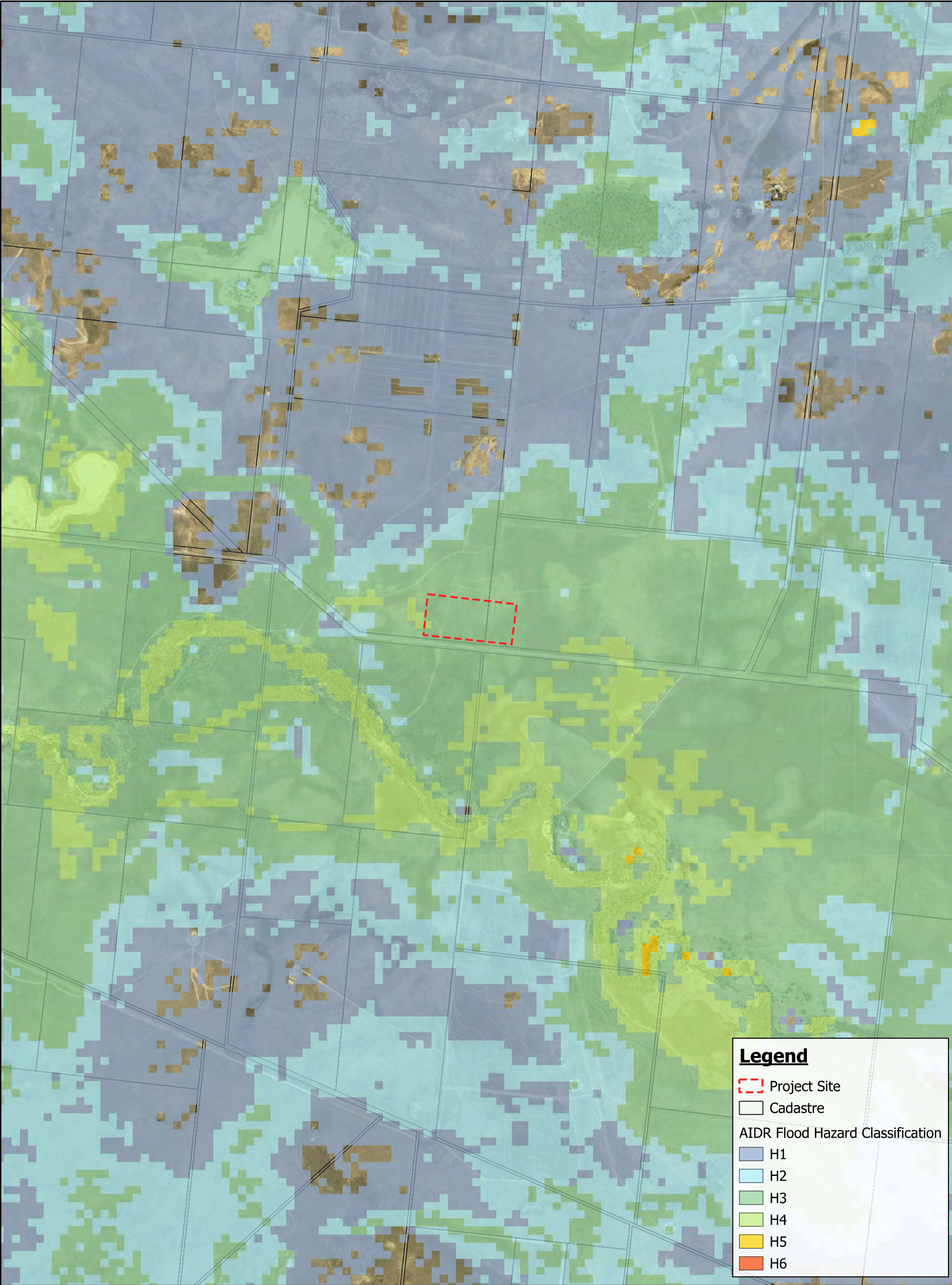
DISCLAIMER
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DATA SOURCE
NSW Government Open Data Source

Appendix B11 - 1% AEP Flood Hazard

Romani BESS
Baseline Results

Drg Ref.



Legend

Project Site

Cadastre

AIDR Flood Hazard Classification

H1

H2

H3

H4

H5

H6

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

N

0200400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

DISCLAIMER
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DATA SOURCE
NSW Government Open Data Source

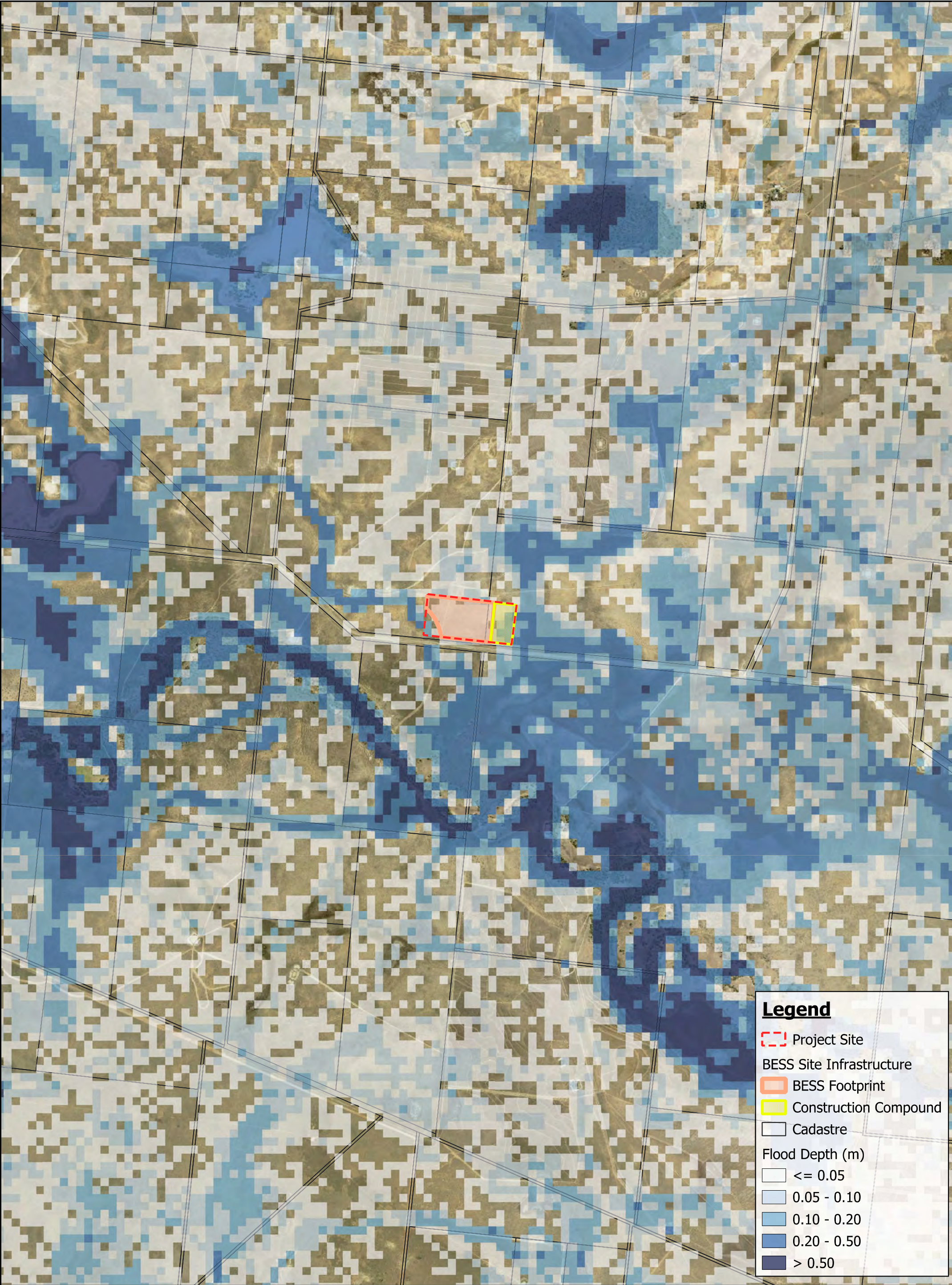
Appendix B12 - PMF Flood Hazard

Romani BESS
Baseline Results

Drg Ref.

APPENDIX C: DEVELOPED CONDITION FLOOD MODELLING RESULTS





Legend

 Project Site

BESS Site Infrastructure

 BESS Footprint

 Construction Compound

 Cadastre

Flood Depth (m)

 <= 0.05

 0.05 - 0.10

 0.10 - 0.20

 0.20 - 0.50

 > 0.50

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			


0 200 400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

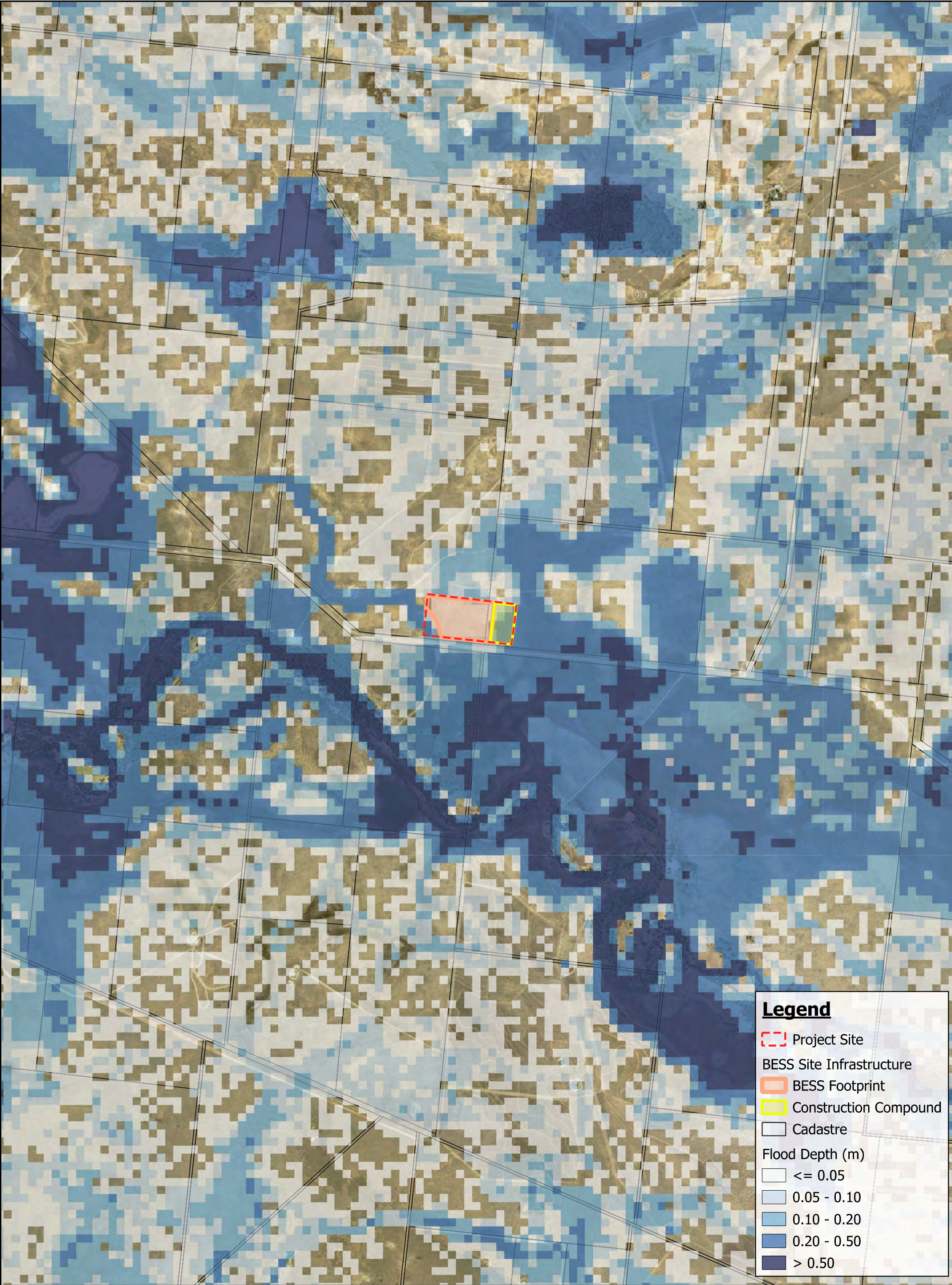
DISCLAIMER
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DATA SOURCE
NSW Government Open Data Source

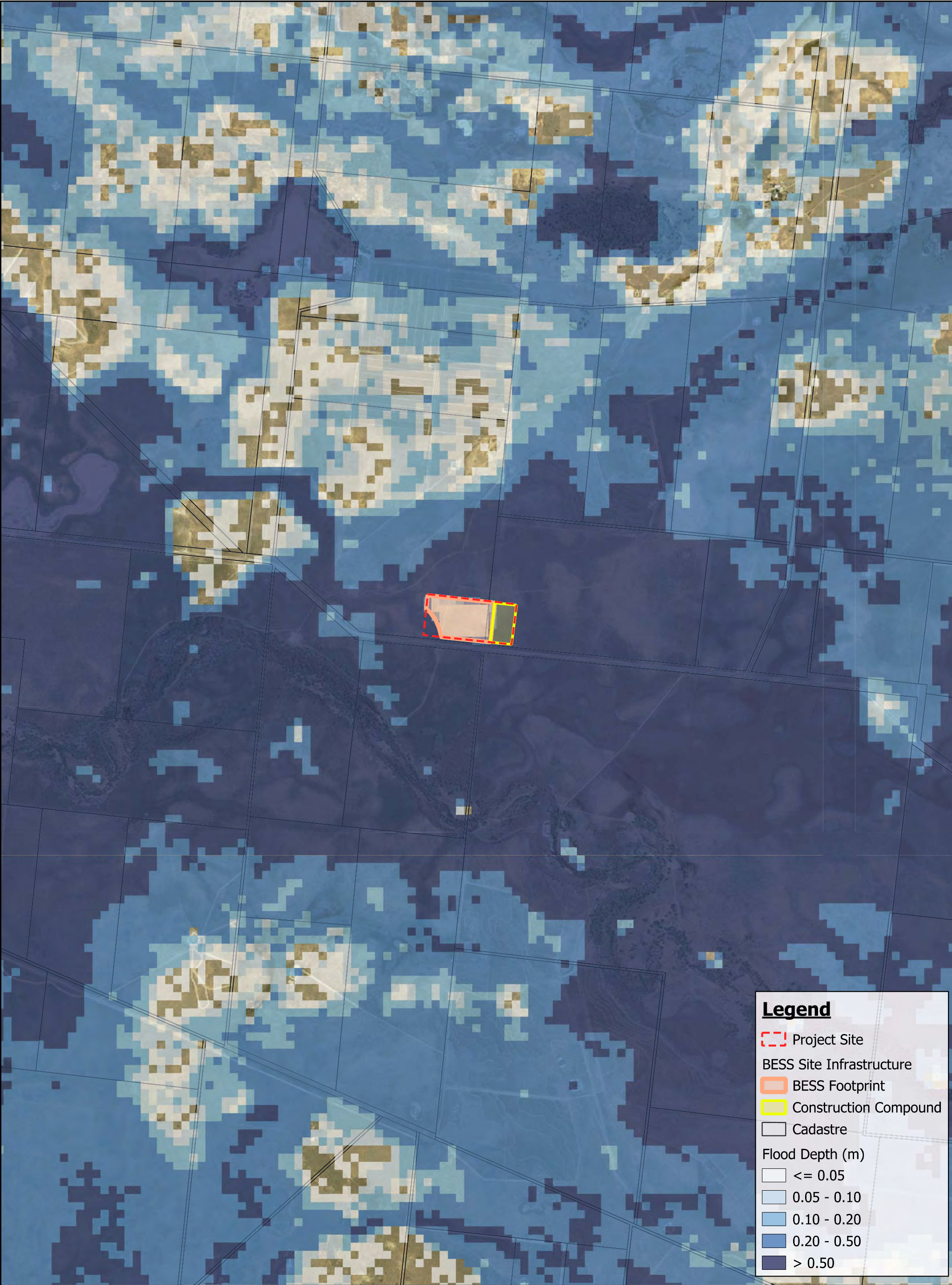




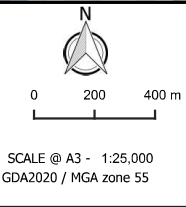
Appendix C1 - 5% AEP Flood Depth
Romani BESS Ultimate Results
Drg Ref.



R		DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.				  SCALE @ A3 - 1:25,000 GDA2020 / MGA zone 55	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source			Appendix C2 - 1% AEP Flood Depth	
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV	Romani BESS Ultimate Results						
			APPROVED	SS	DATE	25-08-2025							
			NOTES:										
Q:\Projects\vx Newcastle\BNTL00206_0007 Samsung Romani Solar Farm\05 Design\QGIS\Workspaces\BNTL00206_0007-WOR-002-D-Samsung Romani Solar TUFLOW RoG Assessment_LV.qgz													
Drg Ref.													



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1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

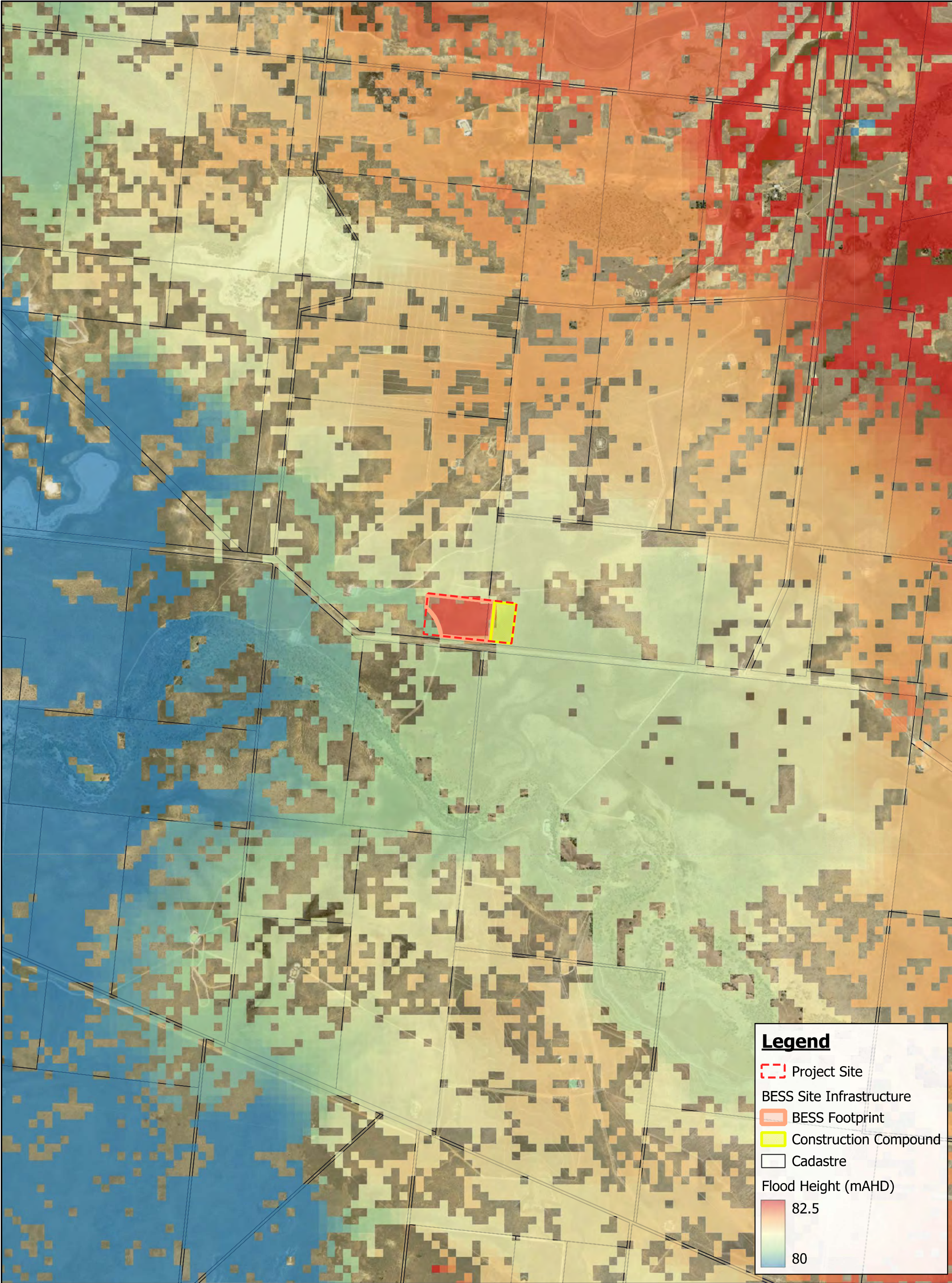


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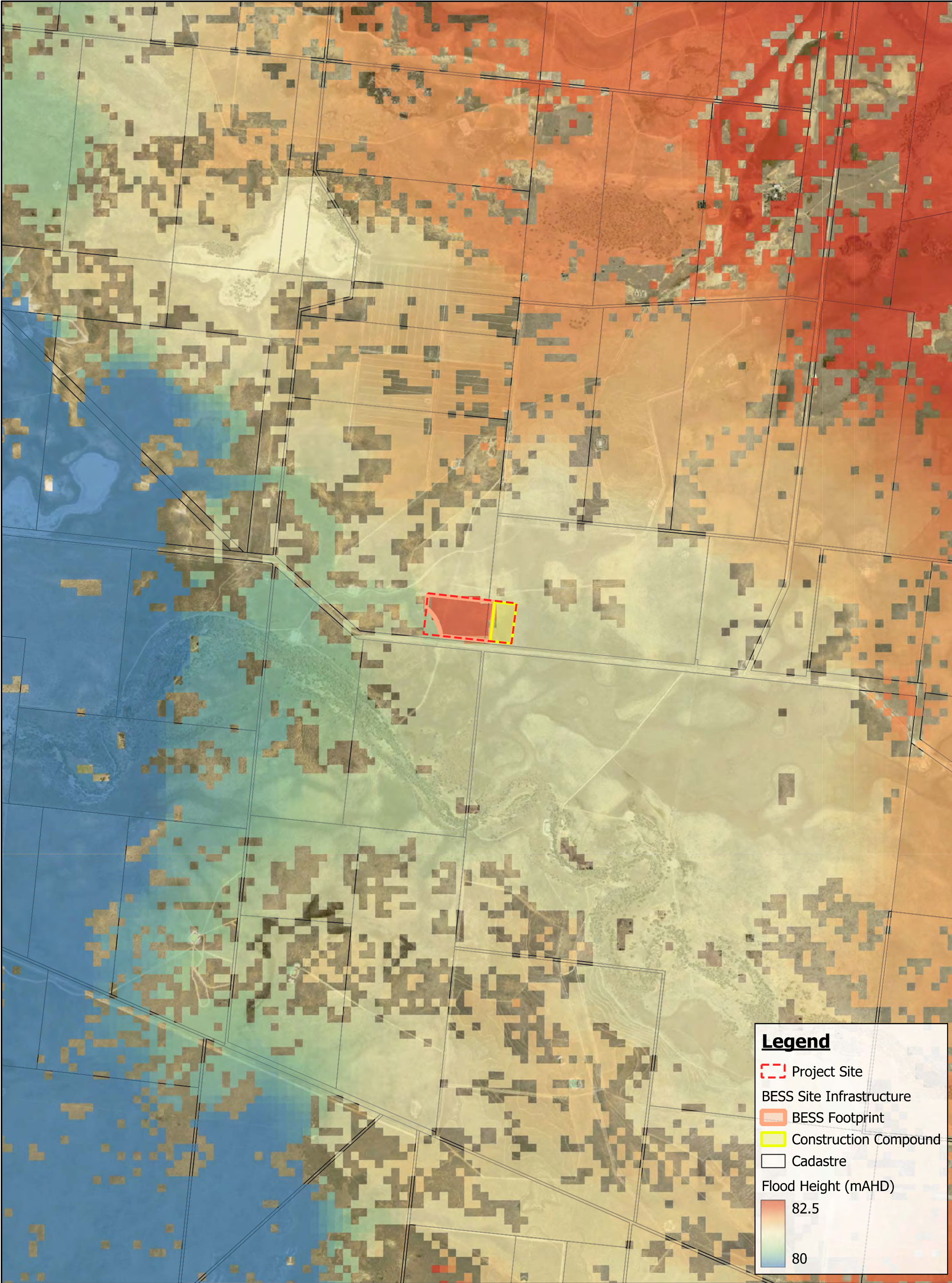
DATA SOURCE
NSW Government Open Data Source



Appendix C3 - PMF Flood Depth
Romani BESS Ultimate Results
Drg Ref.



R DETAILS		DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.				 0 200 400 m SCALE @ A3 - 1:25,000 GDA2020 / MGA zone 55	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source			Appendix C4 - 5% AEP Flood Height
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV					Romani BESS Ultimate Results
			APPROVED	SS	DATE	25-08-2025					
NOTES:											Drg Ref.



Legend

Project Site

BESS Site Infrastructure

BESS Footprint

Construction Compound

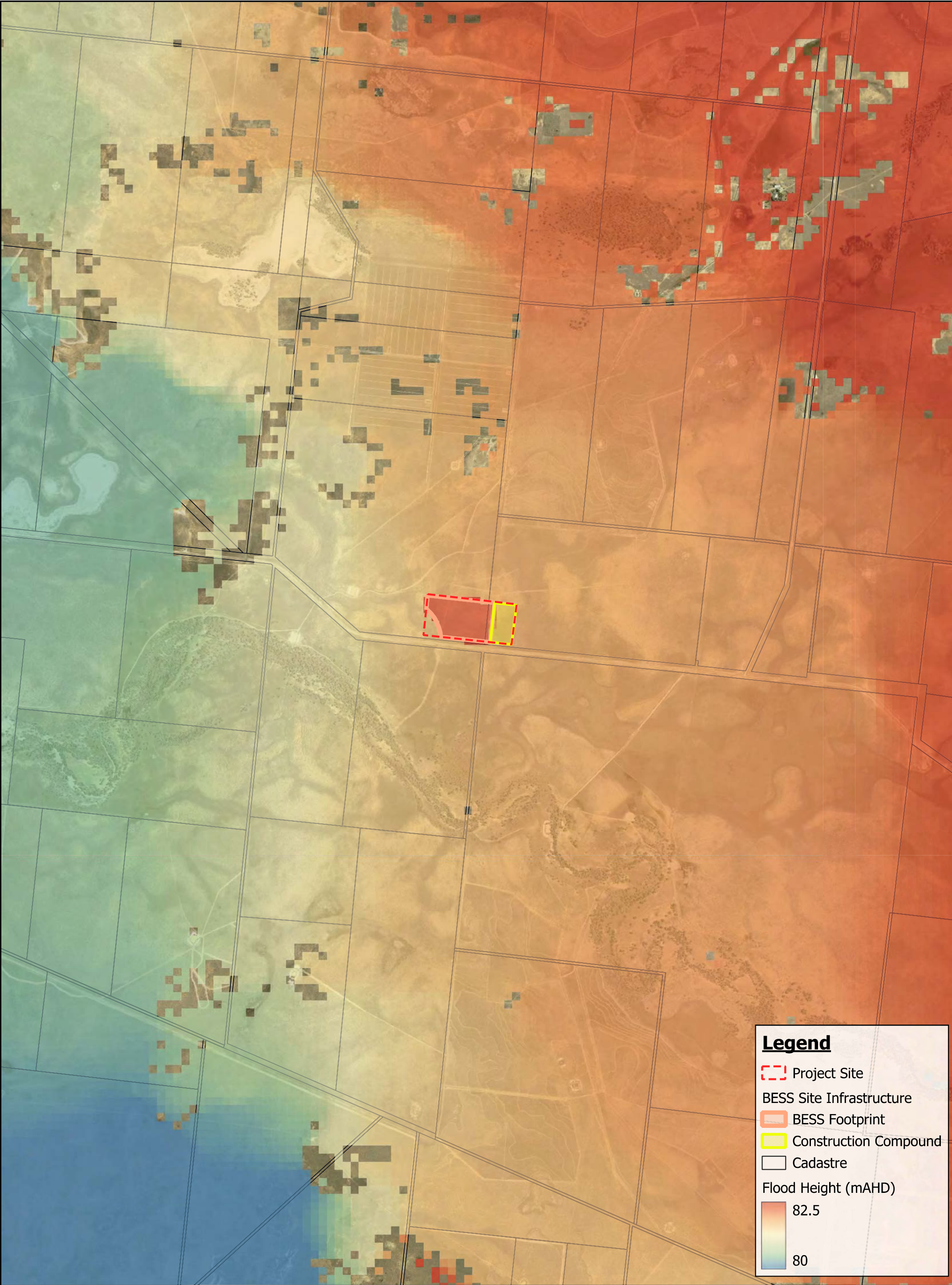
Cadastre

Flood Height (mAHD)

82.5

80

R DETAILS		DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.				N  0200400 m SCALE @ A3 - 1:25,000 GDA2020 / MGA zone 55	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source	 ENGENY		Appendix C5 - 1% AEP Flood Height
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV					Romani BESS Ultimate Results
			APPROVED	SS	DATE	25-08-2025					
			NOTES:								
											Drg Ref.



Legend

Project Site

BESS Site Infrastructure

BESS Footprint

Construction Compound

Cadastre

Flood Height (mAHD)

82.5

80

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

N

0200400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

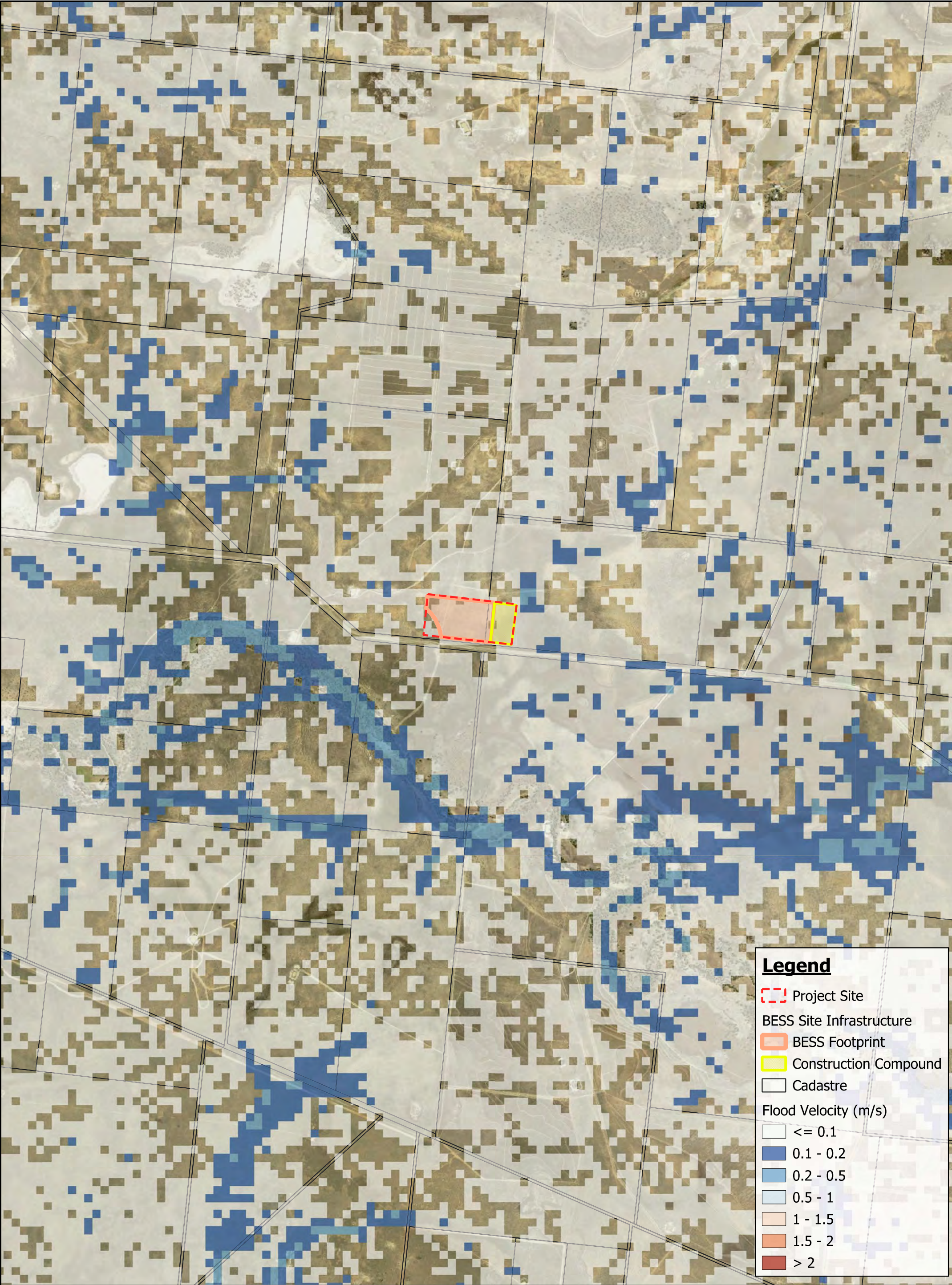
DISCLAIMER

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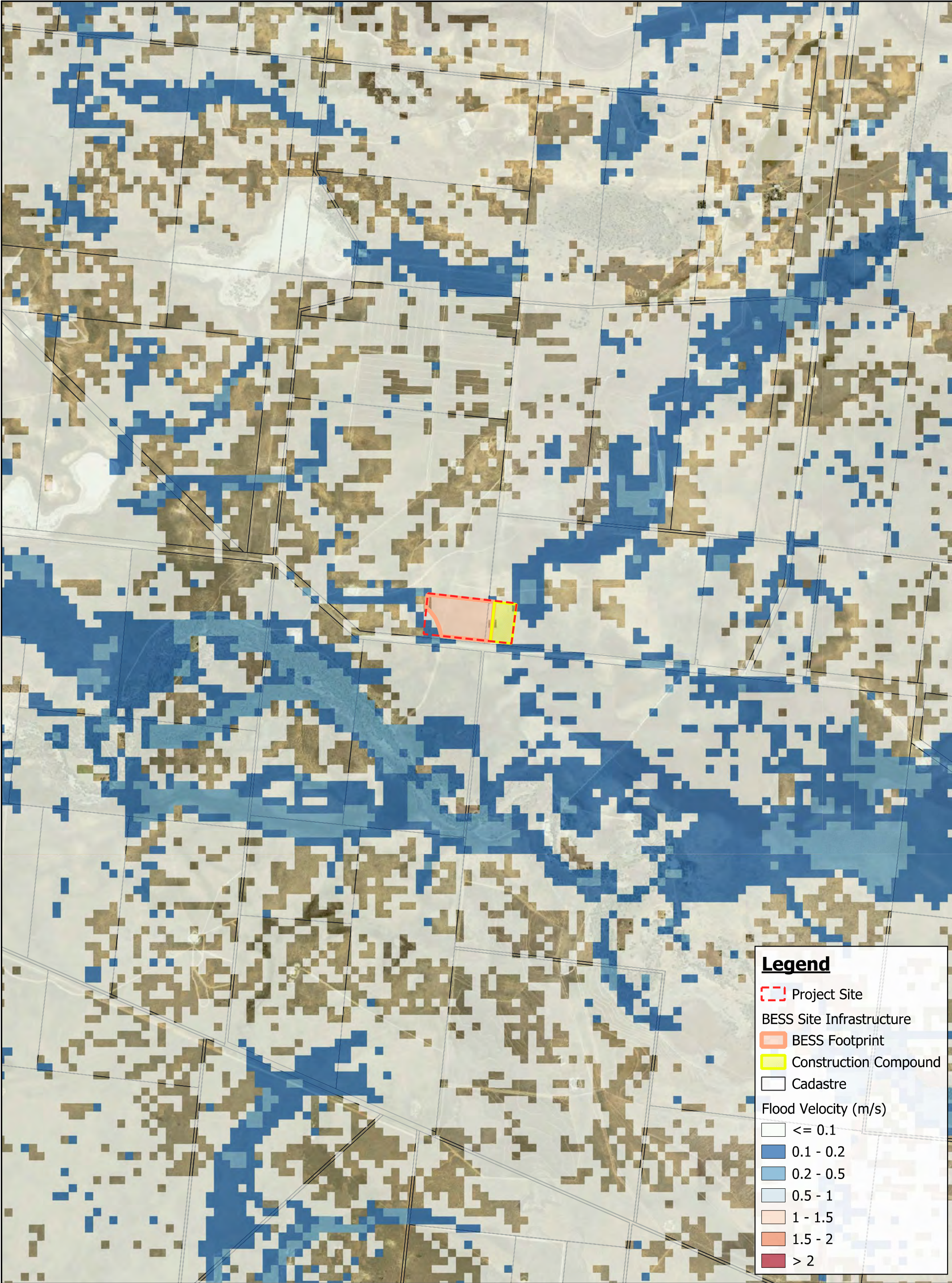
DATA SOURCE

NSW Government Open Data Source

Appendix C6 - PMF Flood Height
Romani BESS Ultimate Results
Drg Ref.



R		DETAILS	DATE		© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.		 0 200 400 m SCALE @ A3 - 1:25,000 GDA2020 / MGA zone 55	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source	 ENGENY		Appendix C7 - 5% AEP Flood Velocity
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV					Romani BESS Ultimate Results
			APPROVED	SS	DATE	25-08-2025					Drg Ref.
			NOTES:								



Legend

Project Site

BESS Site Infrastructure

BESS Footprint

Construction Compound

Cadastre

Flood Velocity (m/s)

<= 0.1

0.1 - 0.2

0.2 - 0.5

0.5 - 1

1 - 1.5

1.5 - 2

> 2

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

N

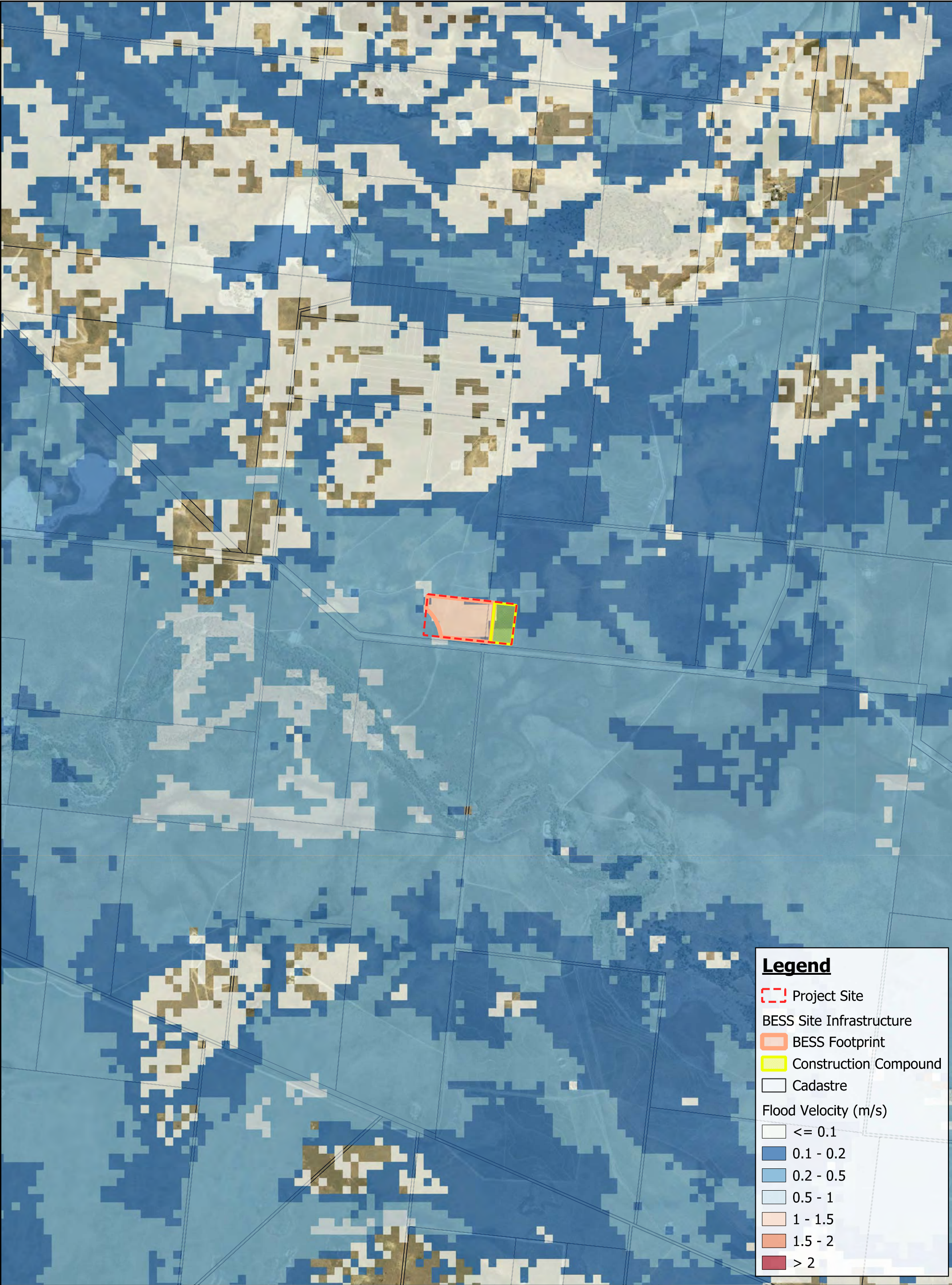
0200400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

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DATA SOURCE
NSW Government Open Data Source

Appendix C8 - 1% AEP Flood Velocity
Romani BESS Ultimate Results
Drg Ref.



Legend

Project Site

BESS Site Infrastructure

BESS Footprint

Construction Compound

Cadastre

Flood Velocity (m/s)

≤ 0.1

0.1 - 0.2

0.2 - 0.5

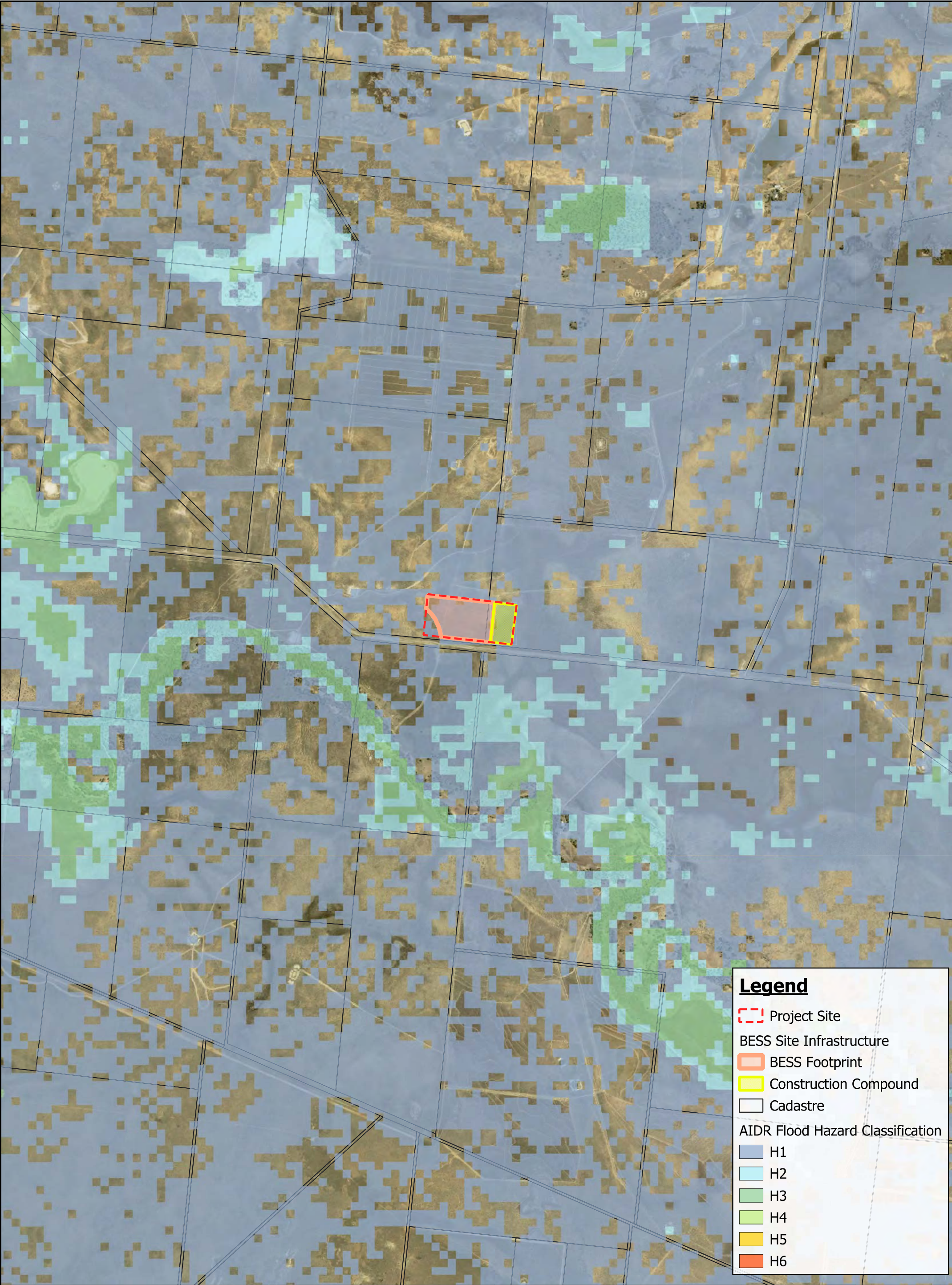
0.5 - 1

1 - 1.5

1.5 - 2

> 2

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.				 0 200 400 m SCALE @ A3 - 1:25,000 GDA2020 / MGA zone 55	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source			Appendix C9 - PMF Flood Velocity
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV					Romani BESS Ultimate Results
			APPROVED	SS	DATE	25-08-2025					
			NOTES:								Drg Ref.



Legend

Project Site

BESS Site Infrastructure

BESS Footprint

Construction Compound

Cadastre

AIDR Flood Hazard Classification

H1

H2

H3

H4

H5

H6

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			

0 200 400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

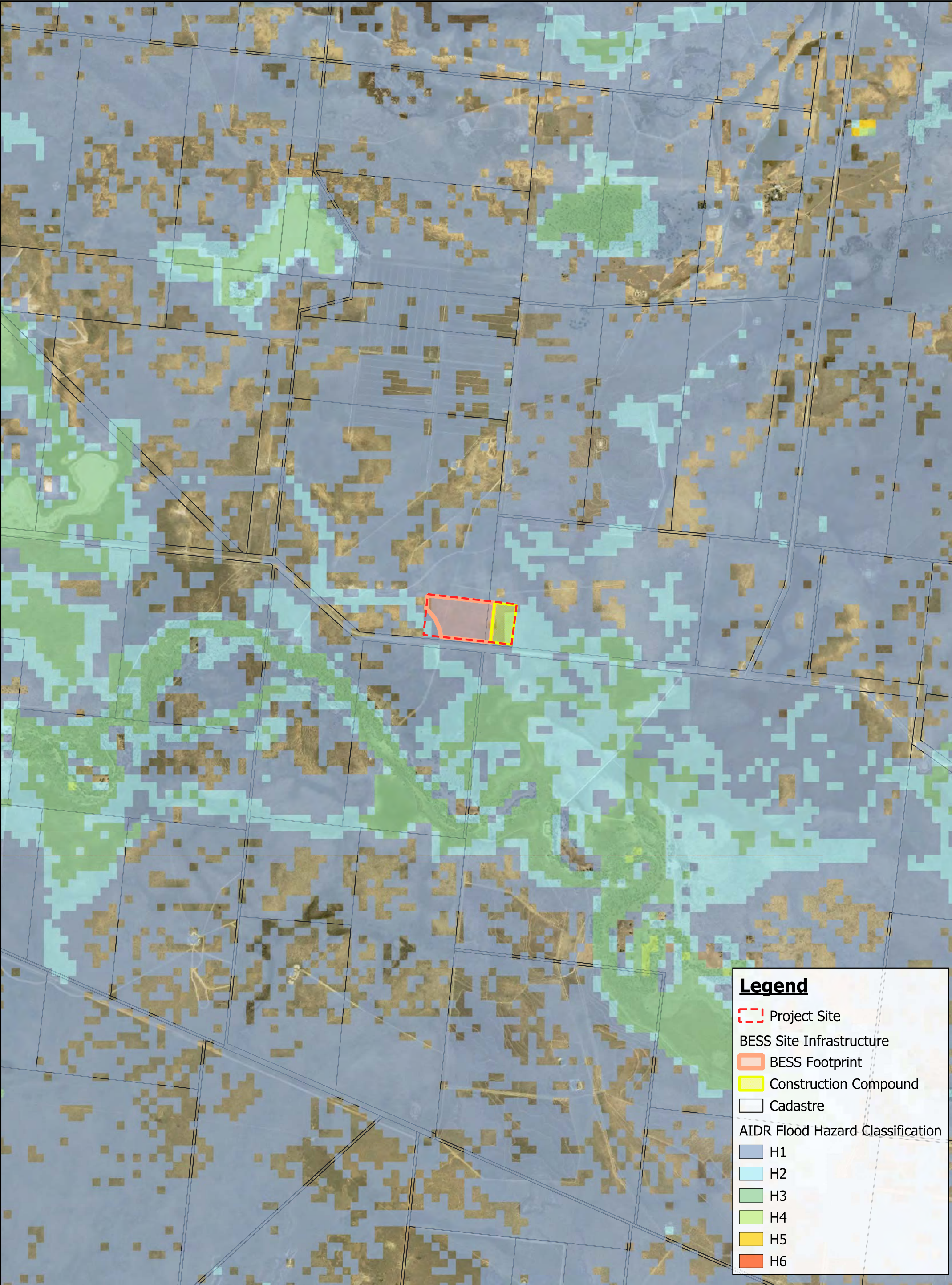
DISCLAIMER
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DATA SOURCE
NSW Government Open Data Source

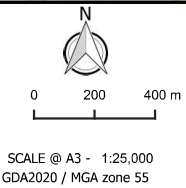
Appendix C10 - 5% AEP Flood Hazard

Romani BESS
Ultimate Results

Drg Ref.



R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			



DISCLAIMER
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DATA SOURCE
NSW Government Open Data Source

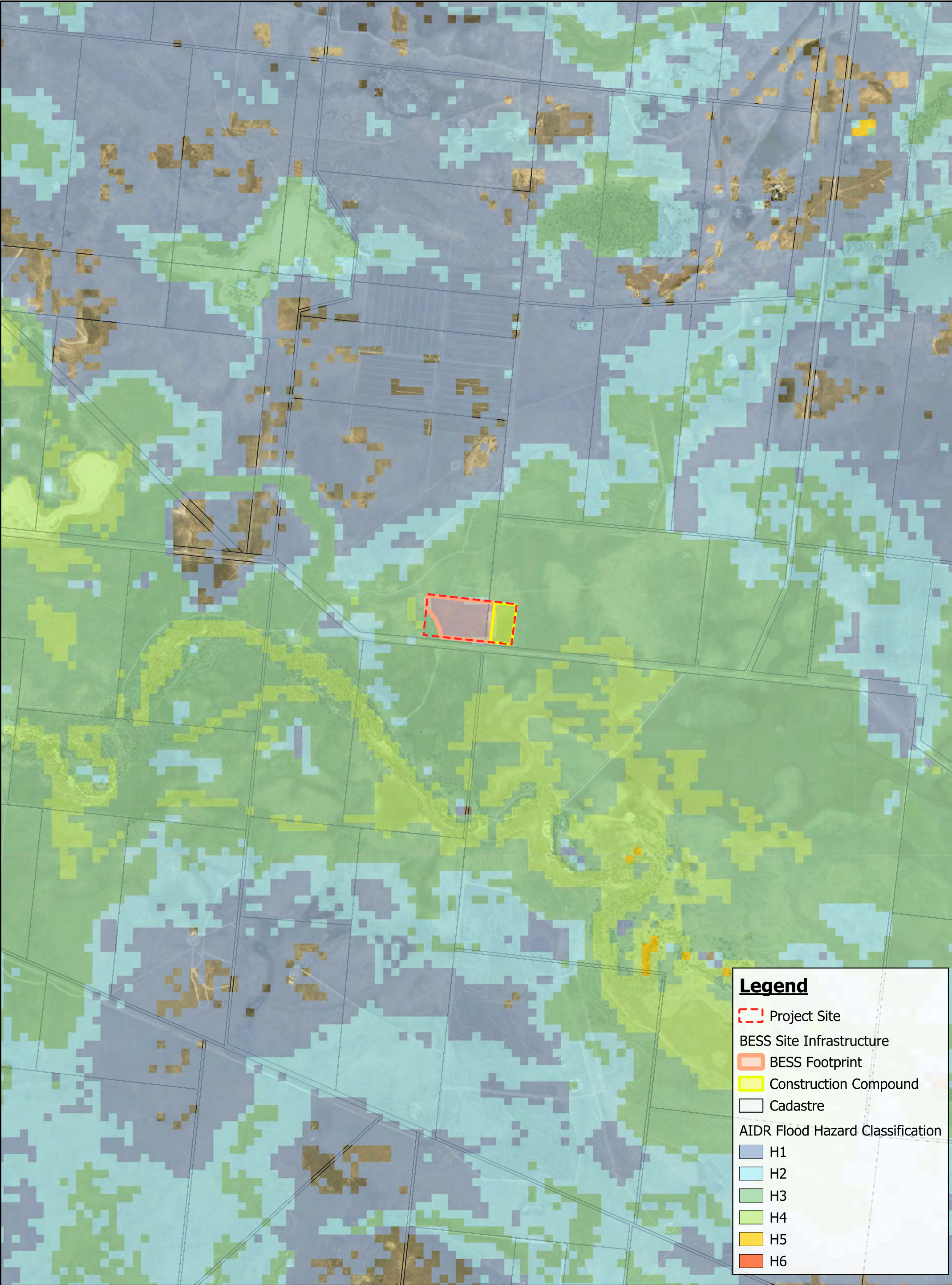




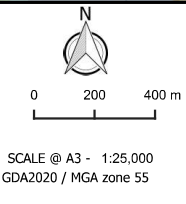
Appendix C11 - 1% AEP Flood Hazard

Romani BESS
Ultimate Results

Drg Ref.



R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			



DISCLAIMER
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DATA SOURCE
NSW Government Open Data Source

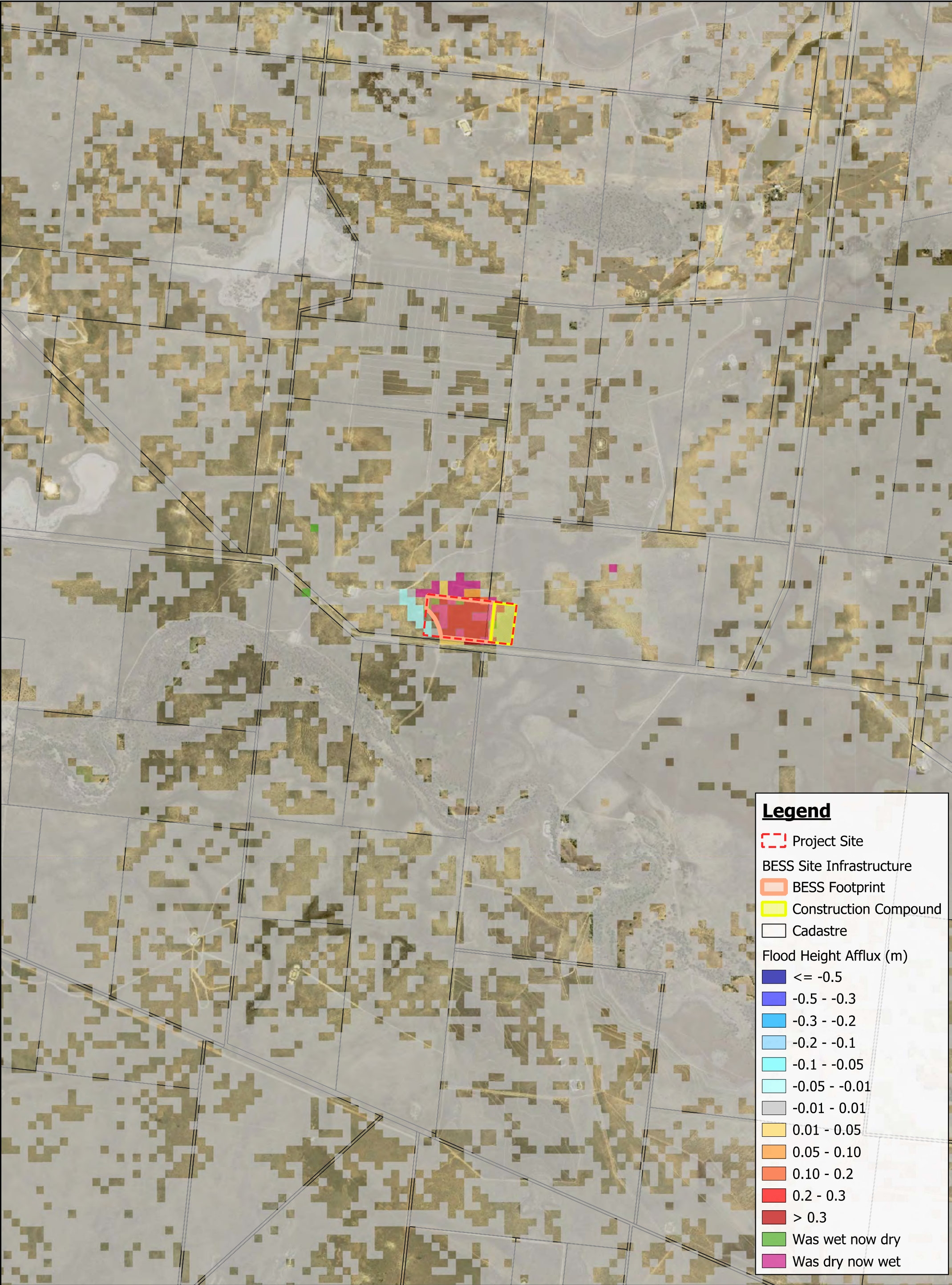
Appendix C12 - PMF Flood Hazard

Romani BESS
Ultimate Results

Drg Ref.

APPENDIX D: AFFLUX FLOOD MODELLING RESULTS





Legend

 Project Site

BESS Site Infrastructure

 BESS Footprint

 Construction Compound

 Cadastre

Flood Height Afflux (m)

 <= -0.5

 -0.5 - -0.3

 -0.3 - -0.2

 -0.2 - -0.1

 -0.1 - -0.05

 -0.05 - -0.01

 -0.01 - 0.01

 0.01 - 0.05

 0.05 - 0.10

 0.10 - 0.2

 0.2 - 0.3

 > 0.3

 Was wet now dry

 Was dry now wet

R	DETAILS	DATE	© COPYRIGHT Engeny This drawing is confidential and shall only be used for the purpose of this project.			
1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
			NOTES:			


0 200 400 m

SCALE @ A3 - 1:25,000
GDA2020 / MGA zone 55

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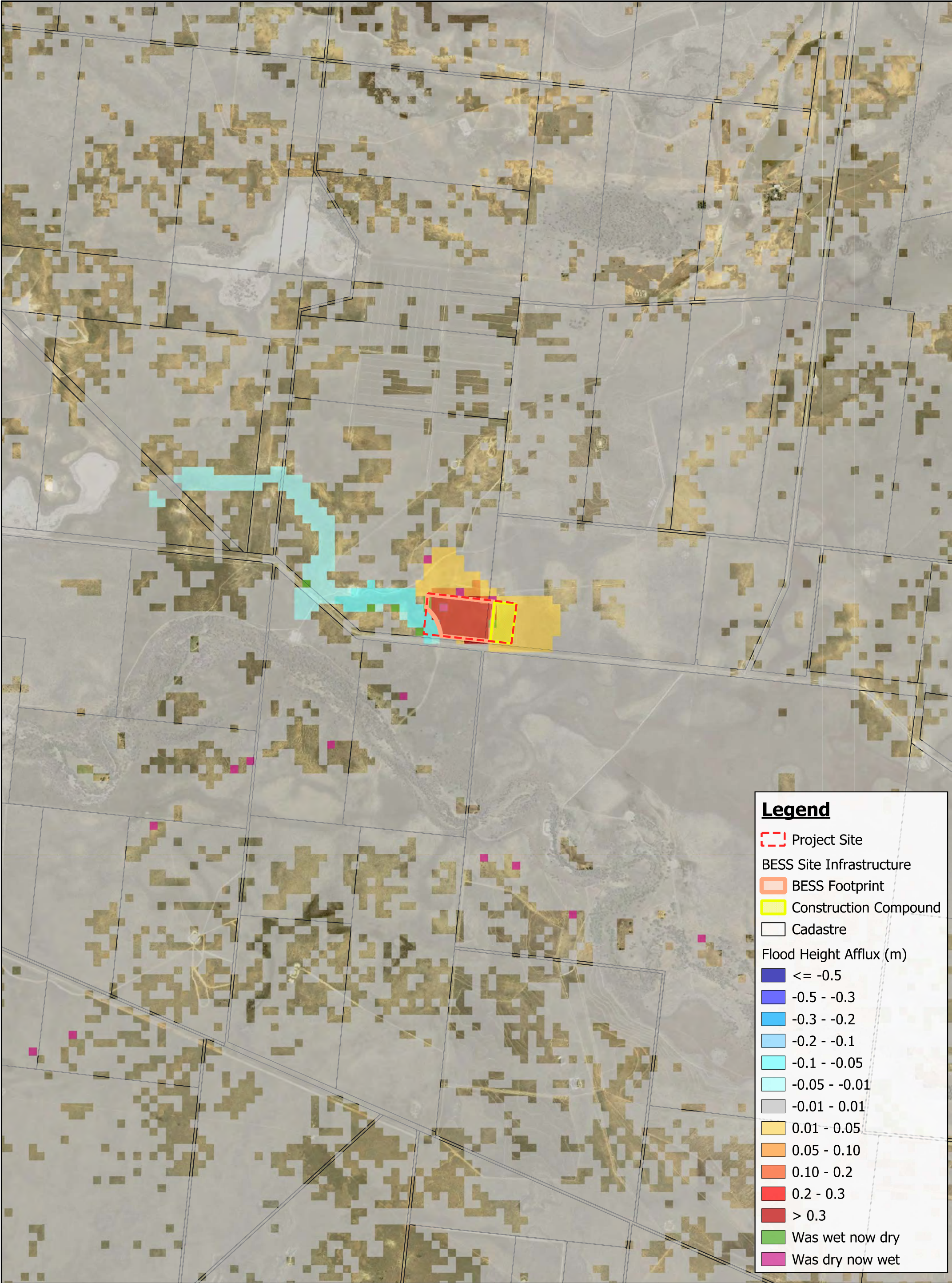
DATA SOURCE
NSW Government Open Data Source



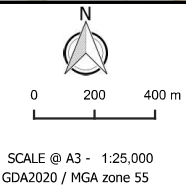


Appendix D1 - 5% AEP Flood Height Afflux
Romani BESS Ultimate vs Baseline Afflux Results
Drq Ref.

Q:\Projects\vx Newcastle\BNTL00206_0007 Samsung Romani Solar Farm\05 Design\QGIS\Workspaces\BNTL00206_0007-WOR-002-D-Samsung Romani Solar TUFLOW RoG Assessment_LV.qgz



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1	Final Issue	25-08-2025	DRAWN	SW	CHECKED	LV
			APPROVED	SS	DATE	25-08-2025
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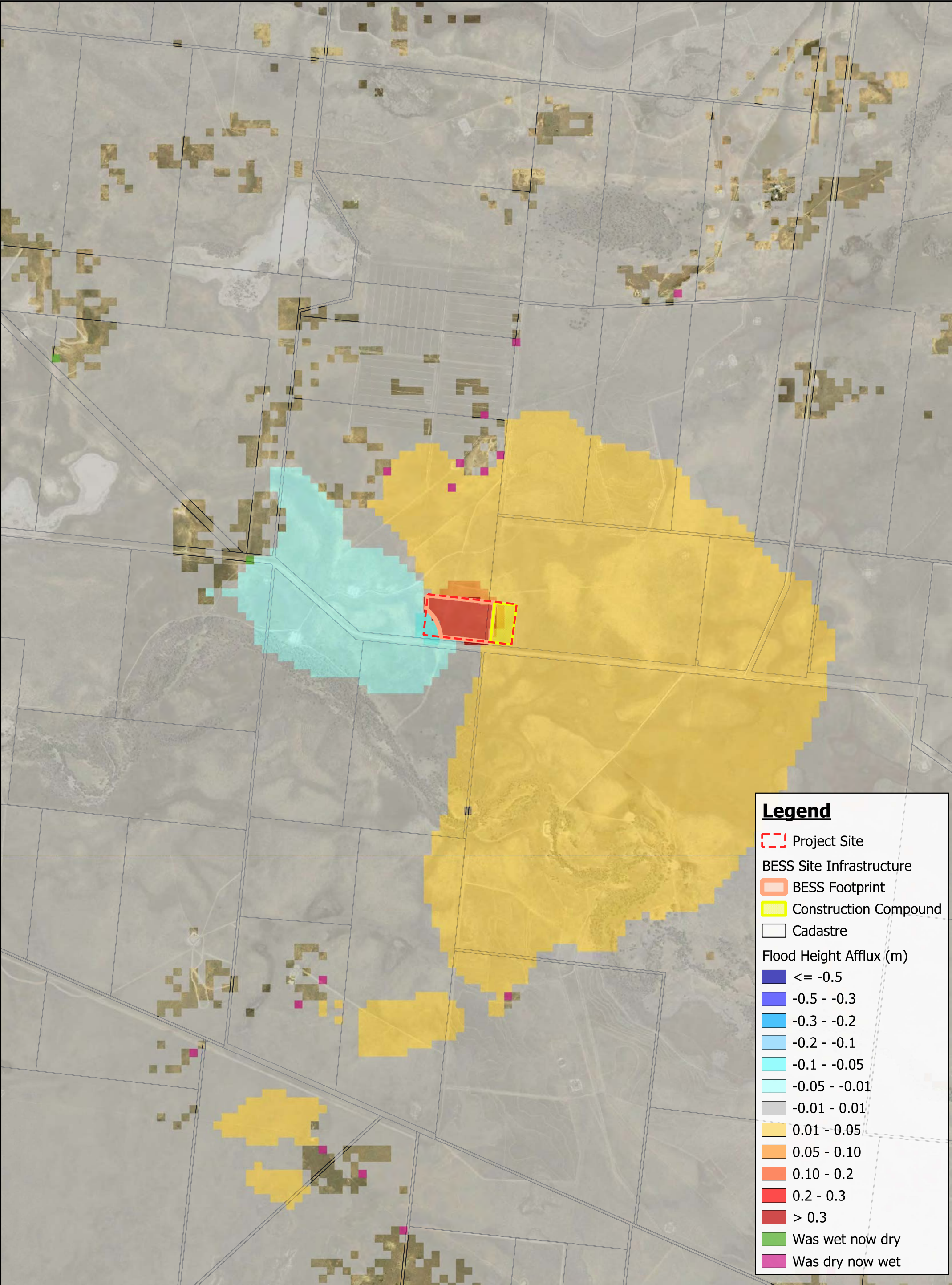




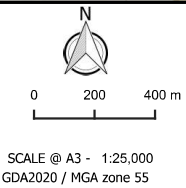
Appendix D2 - 1% AEP Flood Height Afflux

Romani BESS
Ultimate vs Baseline Afflux Results

Drg Ref.



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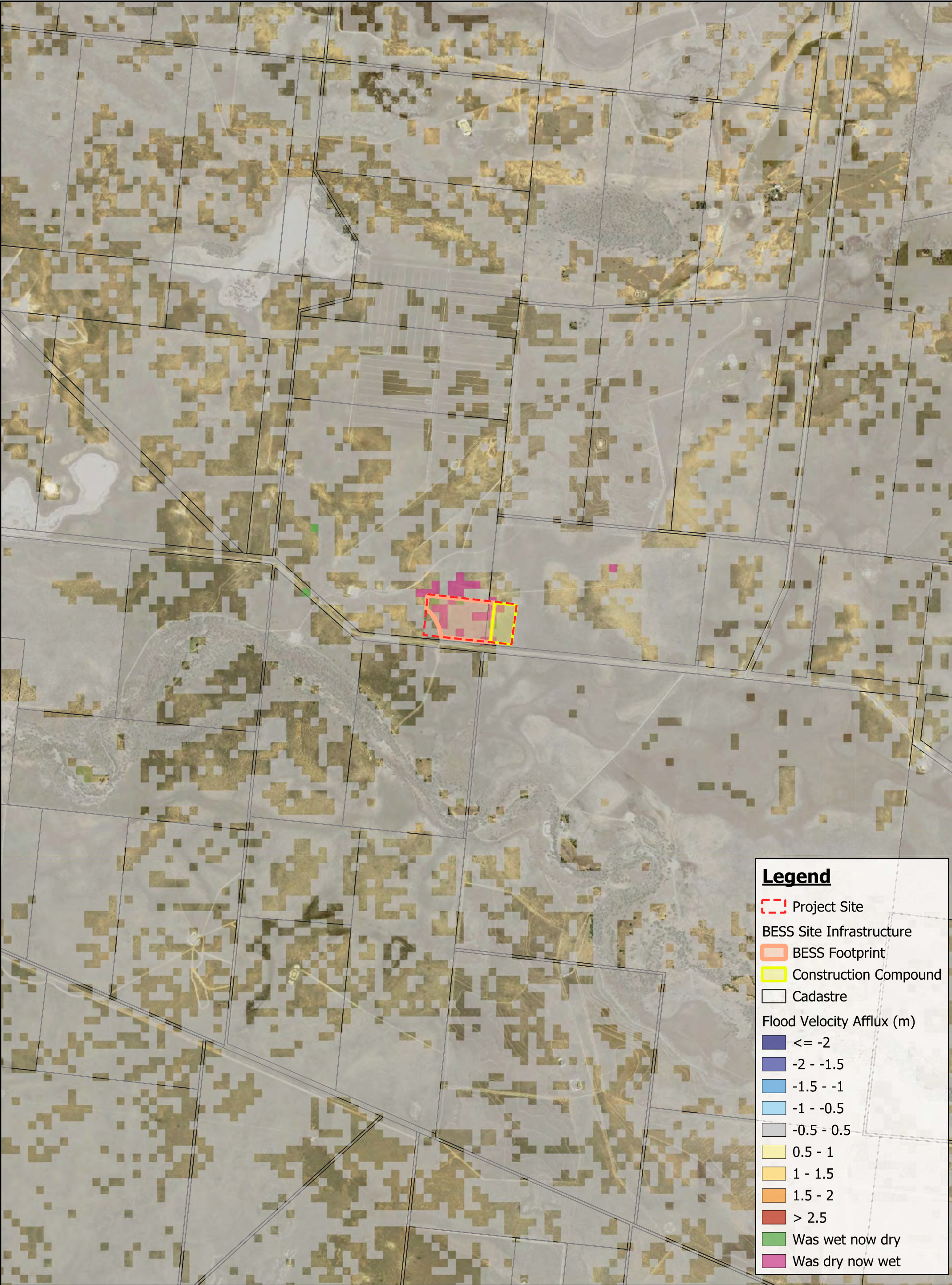




Appendix D3 - PMF Flood Height Afflux

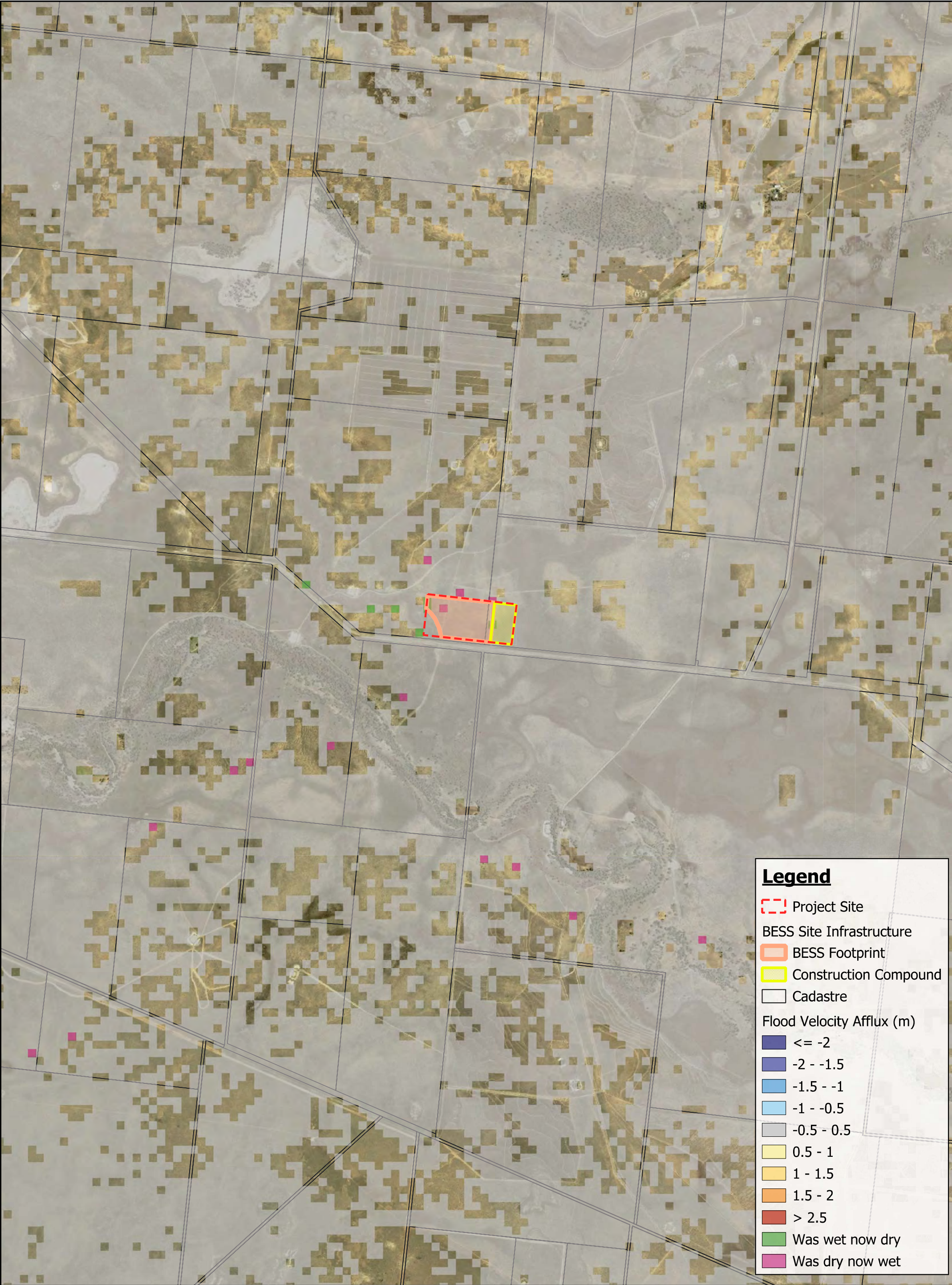
Romani BESS
Ultimate vs Baseline Afflux Results

Drq Ref.

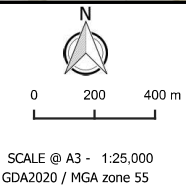


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 0 200 400 m	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source			Appendix D4 - 5% AEP Flood Velocity Afflux
SCALE @ A3 - 1:25,000 GDA2020 / MGA zone 55				Romani BESS Ultimate vs Baseline Afflux Results
				Drg Ref.



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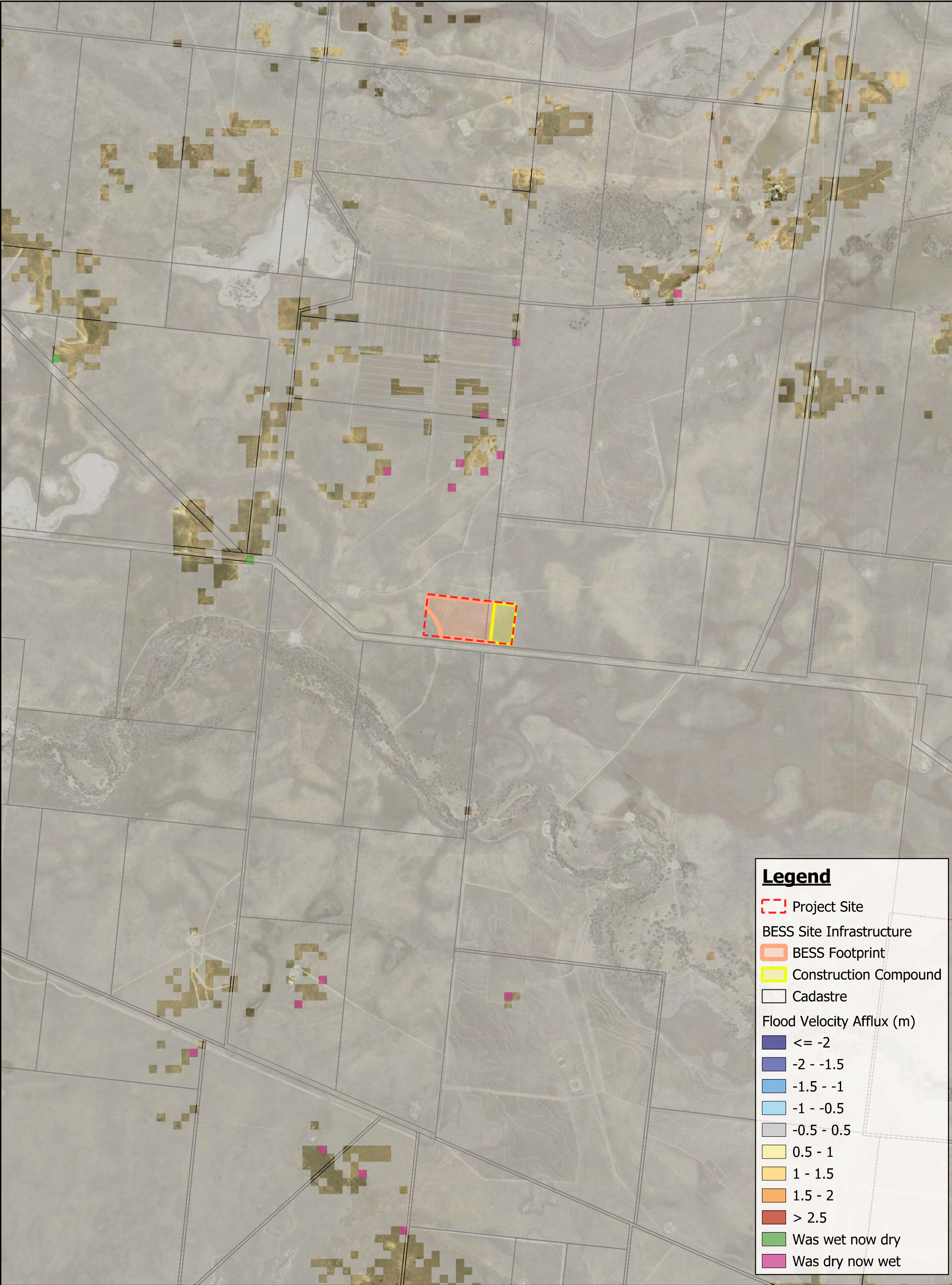




Appendix D5 - 1% AEP Flood Velocity Afflux

Romani BESS
Ultimate vs Baseline Afflux Results

Drg Ref.



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 0 200 400 m SCALE @ A3 - 1:25,000 GDA2020 / MGA zone 55	DISCLAIMER Engeny has endeavoured to ensure accuracy and completeness of the data. Engeny assumes no legal liability or responsibility for any decisions or actions resulting from the information contained within this map. DATA SOURCE NSW Government Open Data Source			Appendix D6 - PMF Flood Velocity Afflux Romani BESS Ultimate vs Baseline Afflux Results Drg Ref.
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APPENDIX E: WATER DEMAND ASSUMPTIONS



Romani BESS Water Demand Calcs



Demand Type	Assumption Description	Assumption	Units	Total Demand (m3)	Total Demand (ML)
Dust Suppression - General	Spray depth per pass	0.3	mm		
Dust Suppression - Roadways	Total length of Proposed Roads	1.6	km	449	0.4
	Road width	5.0	m		
	Total road area	8,047	m2		
	Amount of roadway worked at any one time	10%	%		
	Active construction days (18 months, 6 days/week)	465	days		
	Number of passes per day on active work area	4	passes		
Road Construction / Compaction	Total length of road	1.6	km	978	1.0
	Road width	5.0	m		
	Total road area	8,047	m2		
	Water content added to condition initial rip	8%	%		
	Rip depth	500	mm		
	Dry Density	1,600	kg/m3		
	Total Weight for rip	6,437,279	kg		
	Water content added to condition fill	12%	%		
	Fill Depth	300	mm		
	Total Weight for fill	3,862,367	kg		
Hardstands - Battery Energy Storage (BESS) Switchyard and Substation	Hardstand Area	5,790	m2	334	0.3
	Water content added to condition fill	12%	%		
	Fill Depth	300	mm		
	Dry Density	1,600	kg/m3		
	Total Weight for fill	2,779,200	kg		
Vehicle and Equipment Washdown	Active construction days (18 months, 6 days/week)	465	days	4,650	4.7
	Washdown demand	10,000	L/day		
Potable Water - Peak Rate	Potable Demand	50	L/d/site worker	2,325	2.3
	Active construction days	465	days		
	Active workers	100	FTE		
Potable Water - Average Rate	Potable Demand	50	L/d/site worker	1,860	1.9
	Active construction days	465	days		
	Active workers	80	FTE		
Total Construction Demand - Peak				8,736	8.7
Total Construction Demand - Average				8,271	8.3
Potable Water - Operation	Potable Demand	50	L/d/site worker	65	0.1
	Days (1 year, 5 days/week)	261	days		